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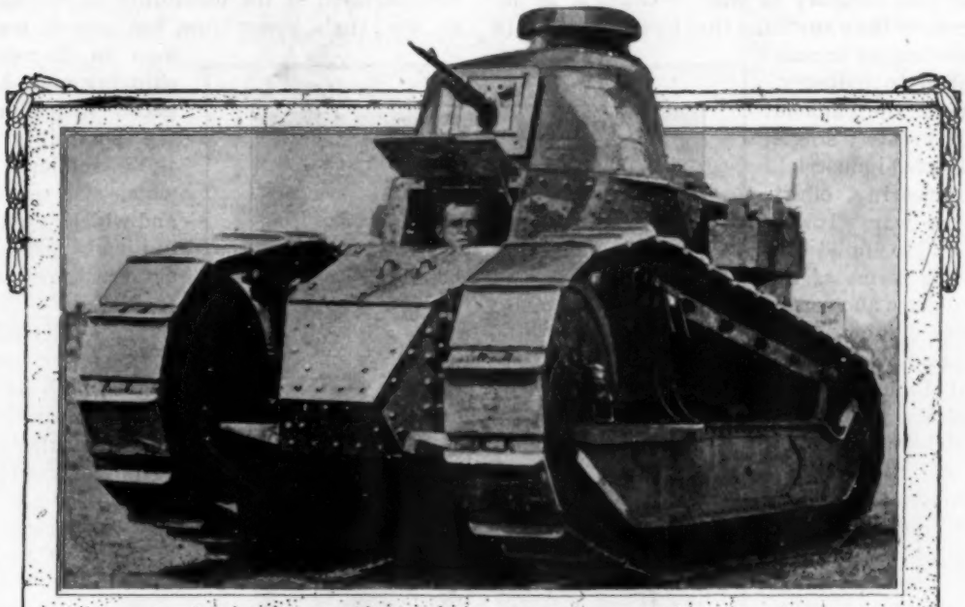


MAPPING OUT *the* ORDNANCE PROGRAM

By John H. Van Deventer,
EDITOR IN CHIEF AMERICAN MACHINIST

In order to make war efficiently the first step is to lay down a general plan. This article describes the work of the Requirements Section of the Estimates and Requirements Division of Ordnance. This is the section that interprets the general war plan into specific items and quantities wanted at specific times, and thus starts procurement activities. Headed by Brig.-Gen. O. C. Horney the work of this division, of which the public has known little, is in reality the starting point of ordnance.

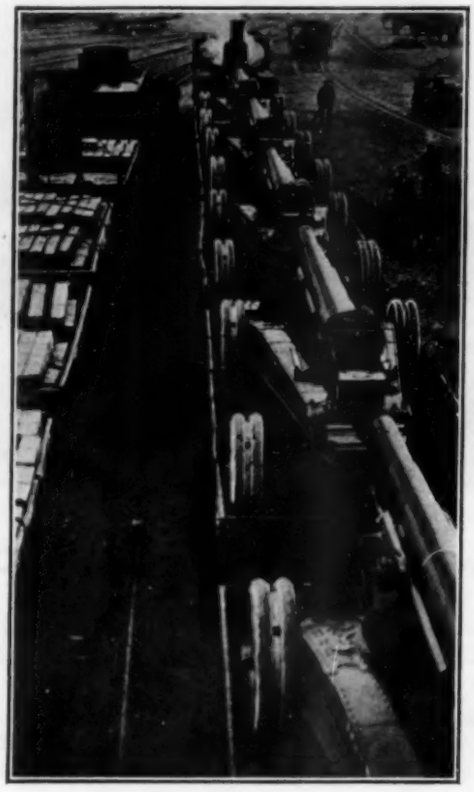
TO THE sales manager of an American shop, the most obvious part of the American Ordnance Department is the Procurement Division. To an engineer or designer who has an idea about an improved gun or flying torpedo, the most obvious division is that which handles ordnance engineering. To the shop man whose plant is one of the many that hang up as a motto "Sleeves up for the flag," the obvious part of Ordnance is that represented by the Inspecspection Division. Without doubt, to the public, one or all of these three divisions are the most obvious part of Ordnance, for they function by coming into touch and keeping in constant touch with American industry. And before Procurement can procure, or Production district offices supervise production, or before there can be anything for Inspection to inspect, someone must say what, when and how many to make of the 100,000 separately manufactured items that Ordnance supplies to the Army. A division of Ordnance little known to the public performs these functions. It is the Estimates and Requirements Division, which starts the ordnance ball rolling by furnishing the detailed data on which the Procurement Division places its contracts.

To figure what and how much ordnance matériel a constantly increasing army 3000 miles away will require month by month is a man-sized job, especially when limited productive capacity and a limited flow of raw materials must be considered. In theory there must be no overproduction of 75-mm. shrapnel at the expense of high-explosive shell of the same caliber; no overproduction of one caliber at the expense of another; no overproduction of shell at the expense of hand grenades; no shortage of optical instruments required for otherwise completed batteries; no shortage of ammunition when guns are ready for it. There must be no excessive piling up of matériel at seaports, nor on the other hand any shortage of this matériel when the ships and men are ready. I say "in theory," because it is beyond human ability to prevent overproduction and shortage or to balance this gigantic program to a nicety. But so far as humanly possible these things are regulated and kept in proportion, for otherwise the war value of our industrial efforts is diminished by the amount that the program is out of balance.

When Ordnance activities are under discussion, if there is to be a proper conception of the task and accomplishment they must be thought of with some per-

ception of the size of the American Ordnance problem. There is no easy way to get a conception of the size of the ordnance problem—in other words, the problem of applying American industry to war—because it is immeasurably greater than anything that has preceded it in the way of coördinated human effort as applied to industry.

The building of the Panama Canal was our greatest single piece of coördinated industrial, or rather engineering, effort previous to the war. It required years to build it. Measured in the terms of its cost, namely, dollars and cents, American effort is now being put into ordnance work at a rate sufficient to complete a Panama canal every 30 days. A modern battleship with all of its armor, engines and guns is a big piece of work, and it is considered remarkable to complete one of them in a year's time. The equivalent of our present rate of effort on ordnance work would complete the largest battleship afloat in one and one-half days. We properly look upon the building of our 16 Government cantonments, with their 32,000 buildings, as a remarkable piece of construction, made possible by excellent organization. The present rate of effort on ordnance would complete these cantonments in one week, buildings, sewers, water supply, power houses, roads and all. One day's effort of Ordnance at its present rate would build complete in every detail seven average-sized freight ships from keels to smokestacks. One day's effort of Ordnance at the present rate would build 400 of the heaviest locomotives complete from cowcatchers to cabs. One day's effort of Ordnance at its present rate would complete 10,000 Cadillac touring cars or 50,000 Fords.



To figure what and how much Ordnance matériel a constantly increasing army 3000 miles away will require month by month is a man-sized job, especially when a limited productive capacity and a limited flow of raw materials must be considered. There must be no excessive piling up of this material at seaports either on this side or on the other, nor must there be any shortage of this material when the men and the ships are ready. Working out the detailed program for the production of Ordnance material is the function of the Estimates and Requirements Division of American Ordnance

Whichever of these comparisons you choose to take in order to get your conception of the ordnance problem it will be entirely sufficient to prove the need of a carefully thought out and balanced manufacturing program, and to show that the slightest unbalancing of this program will cause an enormous decrease in the effectiveness of our efforts. Everything in Ordnance is on so large a scale that errors that would ordinarily be merely poor judgment become calamities.

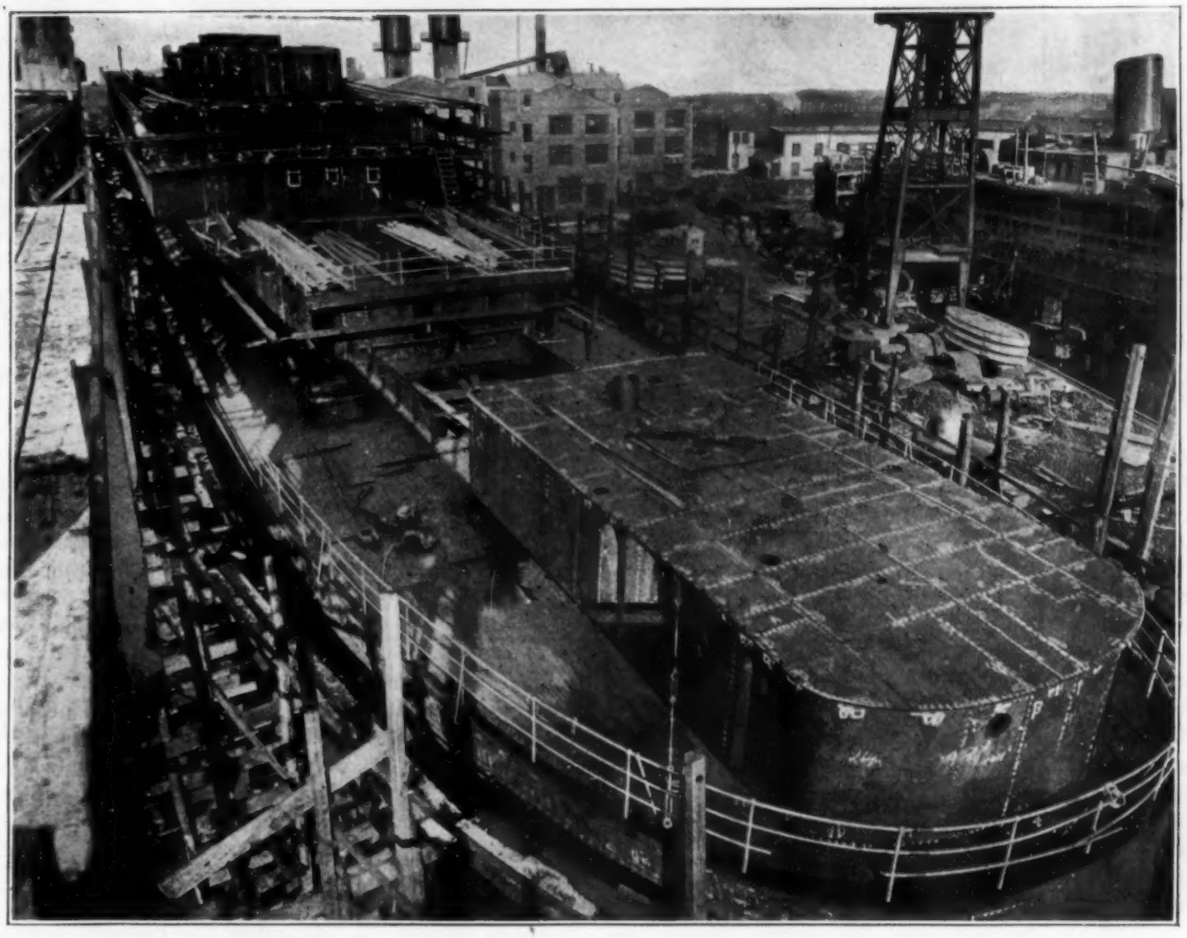
To start at the beginning of a war plan we must go outside of Ordnance. The general plan, known as the Military Program, originates with the General Staff. It is here that the total number of troops required is decided, and the kind of units in which they are to be divided. Such decisions involve not only the consideration of the possibility of raising and training an army in a given time, but also of transporting the men to Europe as fast as shipping and shipbuilding capacity will allow. It involves the possibility of supplying these soldiers with supplies which also require ship space, and which supplies are limited in turn by the limit of existing or creatable manufacturing facilities.

The ability of the railroads to transport men and materials, both here and abroad, and the means of embarkation and particularly of disembarkation of men and goods in France are all important factors in this gigantic algebraic problem. Considering all of these things the General Staff outlines a war program, which schedules month by month the number of men to be called to the colors for training, the number to proceed abroad, and, with proper allowance for casualties, the accumulative total of our effective army. It says that so many of this number will be infantry, so many will be engineers, so many ordnance, so many artillery regiments of this, that and the other caliber (each specified and apportioned), so many of the Signal Corps, the Medical Corps and the aero wing, and that so many shall be applied to Division, Corps and Army headquarters. It also says that each of these organizations shall be composed of certain definitely proportioned components; for example, a field signal battalion shall be made up of battalion headquarters, supply section, radio company, wire company, outpost company and medical detachment. All of which is set forth in what are known as Organization Tables, which not only outline the personnel of each unit of the Army, but states the general equipment with which this unit must be provided.

Taking this same example of a signal battalion again, one organization table will describe the makeup of each of its units. That one which relates to the wire company will state the number and rank of commissioned and noncommissioned officers composing it, as well as the number of privates, and will state that so many rifles, so many revolvers, so many mess kits, so many webb belts, so many rounds of cartridges, so many

wire cutters, so many steel helmets, etc., are required for this company. The War Program, showing the rate of embarkation month by month, and the Army organization tables, showing how an army is made up, from the working basis by means of which Ordnance and the other staff departments figure their detailed quantity requirements and the dates of required delivery.

requires and how fast armies are to be formed, had left little for the Requirements Division of Ordnance to do. As a matter of fact the General Staff provides, and intends to provide, merely the starting point, leaving Ordnance to estimate the quantity of each item of matériel required, the time at which it must be made available, the appropriations which must be made by



One day's effort at the present rate at which American effort is being put into Ordnance work would complete seven of these giant freight carriers from keels to smokestacks. This would include not only the labor in making the hulls and launching them, but also that required to make the boilers and engines and fit out the ships complete in every detail ready to receive their cargoes and start upon their transatlantic voyages

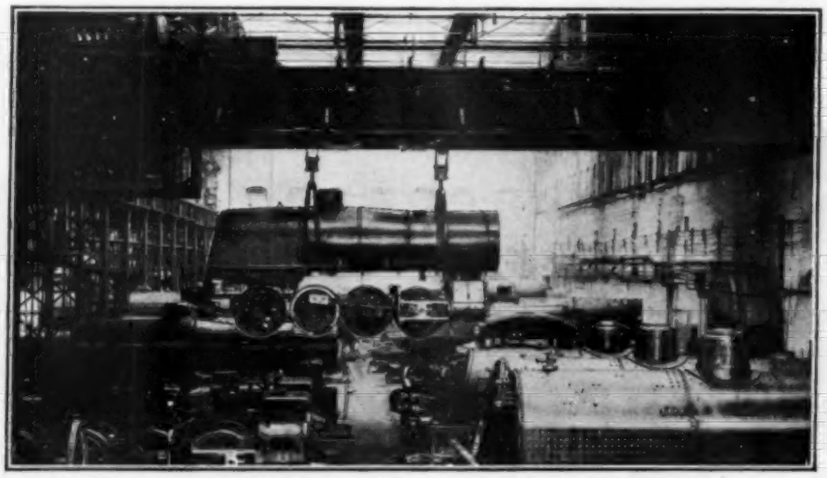
To add to the difficulty of the problem this working basis of necessity is constantly changing. The teachings of experience, both of our Allies and ourselves, must be put into effect even if organization tables are thereby altered and amended. The Engineering Division of Ordnance, for example, developed some months ago a self-propelled caterpillar gun mount which gave the 155-mm. howitzers more mobility than was formerly possessed by light field guns of 75-mm. caliber. Developments and improvements of this kind must naturally be incorporated in a war program as soon as proved of value.

To one unfamiliar with the intricacies of the problem it would seem as though the General Staff, by making such a complete analysis of what an army

Congress to provide for the purchase of the matériel, and the production of a proposed manufacturing schedule, which must take into account manufacturing facilities. It is also a duty of the Estimates and Requirements Division to see that the accepted manufacturing schedule is lived up to. This it does through its Progress Section, the work of which was described in a previous article.

It may seem rather simple, knowing the number of batteries of 75-mm. field guns there are in an army, to estimate the number of guns required and prepare a manufacturing program. The actual computation is much more complex than would be supposed. In the first place it is not only necessary to provide guns for active service at the front, but a large number must be

constantly available as spares. A battery of four field guns were kept in operation on the front lines in the battle of the Aisne, April, 1917. In seven days, two guns of this battery were put out of service by the fire of the enemy, one exploded and seven had to be sent back from this battery to the parks to be repaired. In other words, ten guns were required to keep four operating for a week. The battery mentioned above fired 14,400 shells in this period, or 3600 a gun. It is evident that accurate figures as to the rate of fire for ammunition of every caliber and of the wear and tear on guns of every kind are essential to obtaining a correct idea of the quantities required.



What is being done every day in the application of industrial effort and material to Ordnance work would complete between sunrise and sundown 400 of the heaviest locomotives complete from cowcatchers to cabs. This comparison takes into account the present-day cost of a locomotive, which is almost twice as much as the cost in years previous to the war. Comparisons of this kind are perhaps the only means of giving an adequate conception of the magnitude of American Ordnance efforts. The industrial reconstruction problem is of similar size

Since our forces in France are constantly increasing in number it is also necessary to provide reserves of equipment at the ports of embarkation so that troops arriving there will not be delayed nor obliged to go forward without equipment. This matériel otherwise might fail to go forward on the same ship as the men requiring it or, if it did, might need a longer time to unload and set up than could be spared. Similar reserves must be set up at the proper points in this country in order to guard against irregularities in the delivery of matériel at the ports of embarkation and to compensate for irregularities in railroad transportation such as occurred during the severe storms of last winter. It is also necessary to estimate the amount of matériel required to replace that worn out in service, captured by the enemy or made unavailable through any one of a variety of ways, as, for example, the necessity for returning it to repair shops.

How Tables of Requirements Are Prepared

As the general method of computing requirements devised by the Ordnance has been adopted by all the other bureaus of the War Department, it may be of interest to the reader to have it described in some detail. The number of men to be provided for is specified by the War Plans Division of the General Staff as previously mentioned. The kinds and amounts of the initial issue of equipment per unit of the various forces is set forth in the unit equipment tables compiled by the Military Data Unit of the Requirements Section. These must be consolidated into the requirements for an army and, for example, the total number of pistols required for initial equipment is found by adding up the number required for the infantry regiments, the field artillery, the engineer regiments, the ammunition train, aero wing, field signal battalion, division corps, and army headquarters, etc. Having obtained the total of this one item of equipment for an army, the fractional part of an army to be provided for each month is set down in columns 3 or 4 according to the War Program which gives the number of trained men to be shipped each month overseas. The amount that will be used up or broken during the training period in the United States is set down in column 6, after having been estimated from experience. The reserves necessary are set down in columns 8, 9 and 10. Initial equipment that is issued overseas is set down in columns 13 and 14, while the amounts required for wastage and consumption are computed from the best experience available and set down in column 15. Reserves for overseas are computed in column 16 and the grand total is shown by months in column 19.

Raw Material Supplies Must Be Investigated

This is antedated sufficiently to allow for the time required for shipment, so the finished schedule represents a buying program corresponding to factory delivery. This is reviewed and approved and is then transmitted through the Project Section to the Procurement Division as a buying program to which contracts for manufacture and delivery of pistols are to be made to conform.

Having the monthly requirements of a single item such as the above it is then possible to compute the amount of raw material required to make it. The unit amounts of the different components are obtained from the Engineering Division and multiplied out. Thus the amount of steel required each month for each of the different kinds and sizes of shell, guns, etc., can be computed and the individual amounts consolidated into a total monthly requirement for steel, smokeless powder, copper and other materials. This information is im-

portant, as it indicates whether the available sources of raw materials are sufficient or whether it will be necessary to develop additional ones, build new plants, etc. Some of these investigations are extremely complicated and detailed, as, for example, to determine the total of optical equipment needed for an army and from that find the amount of optical glass needed for all of these instruments.

How Many Spare Parts Will Be Needed for Each Gun

With each major item of ordnance matériel an astonishing number of other items are required to permit its complete and successful use.

One of the most difficult problems in the estimating of requirements is the determination of the number of spare parts required to keep equipment in operation. Even the simplest item of ordnance matériel is made up of a number of parts, and the larger items run into astonishing figures. The carriage for the 240-mm. howitzer is made up of close to 2500 individual parts, none of which were being made in this country before our entrance into the war. In order to permit the quick repair of these mechanisms when in use in the field, spare parts in sufficient number must be made available at a point close to where the matériel is in use.

It is a problem both interesting and difficult to determine how many and what spare parts should be kept at hand. It is not practical to assume the maximum number that might be required and make that the standard, for the production of an excessive number of spare parts would decrease the manufacture of complete items. On the other hand if an insufficient number of spare parts are available a vitally needed piece of ordnance may be put out of action for the lack of some part which is required to repair it and to restore it to use. Only the most complete experience would permit anything like an accurate determination of the exact quantity required, and all the experience that was available was that of our European allies with similar types of matériel. The simplest and most practicable solution was the provision that with each important item of ordnance matériel a supply of spare parts estimated to serve to repair a given number of the major item, say a hundred or a thousand, over a period of six months or a year should be shipped with the corresponding number of items.

How the Automatic Supply Table Works

Provision for the correction of this preliminary estimate was made by the creation of what is known as an automatic supply table. This is set up by the chief Ordnance officer of the American Expeditionary Forces and represents his instructions that for a unit number of troops in France a given number of spare parts will be required in addition to those which are furnished with the equipment itself. In this way any item of which an increased supply is required can be requisitioned and will be sent automatically each month until instructions to the contrary are received.

Some of the ablest statisticians of the country have been engaged in this work of figuring the requirements of an army and have found it to be a task fully equal to their best efforts.

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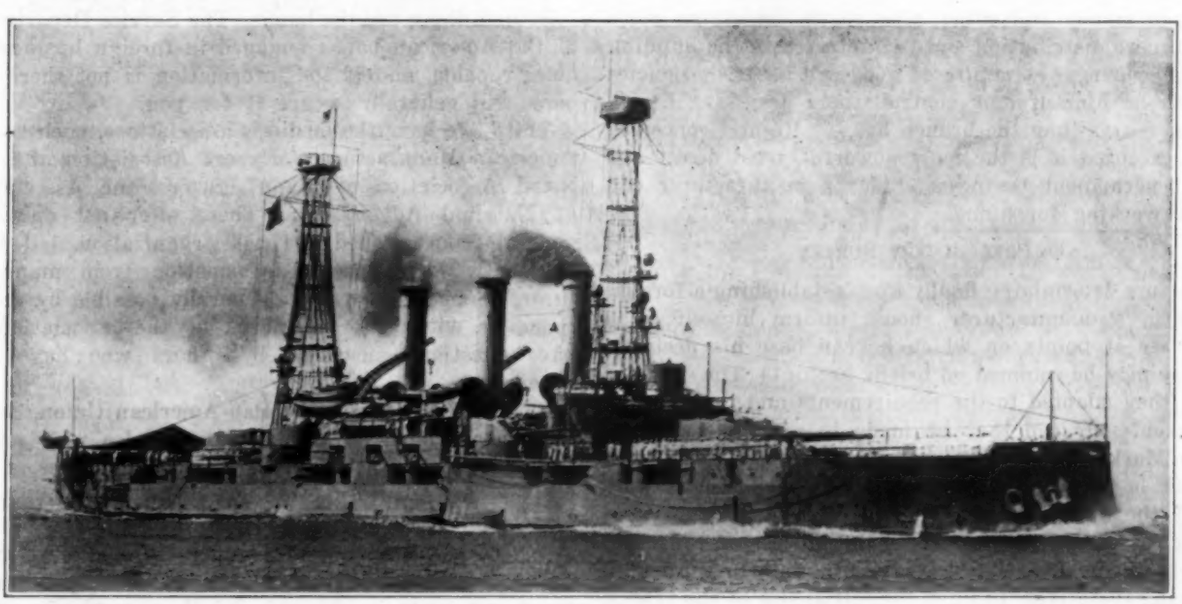


The equivalent of our present rate of effort in American shops on Ordnance work would complete the largest battleship afloat in one and one-half days. A modern battleship with all of its armor, boilers, engines and auxiliary equipment, its great and small guns and the thousand items which go to make it complete is a piece of work that in normal times requires from two to three years' labor for its completion

How a Manufacturer Can Establish His Own Organization Abroad*

By WILLIAM INGERSOLL
Of Robt. H. Ingersoll & Bros.

PERHAPS I ought to preface this discussion by the question "Should a manufacturer establish his own organization abroad?" The foreign-branch method of selling does not fit all organizations. To the manufacturer to whom foreign trade is regarded chiefly as a "safety valve"—to be operated at full blast when there is heavy stock pressure and small domestic demands, and to be neglected when business is good at home—obviously such a concern could not use a branch abroad. Nor can the small manufacturer just beginning to sell goods outside of this country or the manufacturer whose sales are necessarily limited away from home.

But apart from such obvious cases there are many concerns to whom the foreign branch will not appeal. To begin with, as a method it is apt to be complex. It does not represent operating along the line of least resistance. It calls for a higher order of organizing and administrating ability than any other method of foreign selling. It requires investment, involves financial risk, and it makes necessary a thorough first-hand knowledge of conditions in the country to be covered. To the manufacturer who is not willing to accept these conditions my advice is: "Do not open a foreign branch." The export commission house, the general or local distributor on the grounds, the manufacturer's agent—all of these offer excellent facilities for the sale of goods with few of the above-mentioned difficulties.

But for the manufacturer who is willing to pay the cost in money and effort, who wants something more than mere distribution and is interested in the building of a permanent structure of good-will based on policies which he himself may control, there are few, if any, surer means than the branch house. Rightly conceived and executed it is the most powerful, most direct and most permanent business builder a manufacturer can have working for him.

Preliminary Survey

Before determining finally upon establishing a foreign branch, a manufacturer should inform himself on a number of points on which he can base his decision. These may be summed up briefly as: (1) The Goods—Are they adapted to the requirements and taste of the market? Or can they be made to meet them? (2) The Market—Assuming that the goods and prices are right, is there an ultimate market big enough to warrant the opening of a branch? Can it be cultivated at a reasonable cost, or would the process of education be too long and expensive? (3) The Investment—Having tentatively in mind the initial size of the branch organization, what would the investment be? And how long is the manufacturer prepared to face a deficit before the branch may be expected to begin paying dividends? (4) The Volume of Sales and Profits—Are they big enough to carry the overheads of a branch? If not, could other goods be added to reduce the overhead?

Just a few words on how information on the foregoing might be obtained. Of course the obvious and one best source is right in the country to be developed, and if at all possible a visit should be made by someone capable of observing and drawing accurate conclusions. Such a trip would not enable the manufacturer to determine definitely the desirability of establishing a branch, but it could be made the basis of actual establishment, the policies to be followed, etc.

Judging the Field

Assuming that for some reason a representative cannot make a tour of the country there are many ways of "sizing up" the field. Probably all of the following sources are entirely familiar to you, nevertheless I will mention them chiefly as a reminder:

First, there are the Government agencies, such as the Bureau of Foreign and Domestic Commerce of the Department of Commerce. Here are the reports of special agents, of general commercial attachés, of consuls and of all the many other excellent sources from which this bureau gathers its information. If time permits, special information may also be had by correspondence with the representative on the ground, through the bureau. If it does not there is a wealth of material already available and classified according to lines of business, country and in other ways.

Second, there are the banks. The Service Department of the American banks engaged in foreign business is quite capable, and if the information is not there the bank will generally secure it for you.

Third, we have the business associations, such as the American Manufacturers' Export Association, the National Association of Manufacturers, the Association of National Advertisers. These offer not only the general report issued by each organization, but they frequently have specific information from manufacturers themselves, or it is generally possible by corresponding with other members of the association to have questions answered by others who have had experience.

Such associations as the Pan-American Union, covering certain parts of the world, are also very useful in getting information on the various countries.

Location and Size of Branch

Where the branch is to be located and how much of an organization it should constitute depend upon the territory to be covered and the manner in which the goods are to be sold. For instance in a country well covered by transportation lines, where access is fairly easy from one part to another, a single branch is likely to be sufficient. On the other hand in lands where the population is divided into groups, each group inadequately connected by transportation, such as in Brazil, sub-branches or even additional full-fledged

*Address delivered at the annual convention of the American Manufacturers' Export Association held in New York on Oct. 30-31, 1918.

branches may be necessary. Transportation facilities should have an important bearing on the decision as to where a branch should be located.

Tariffs are another consideration. A free-trade country offers opportunities for a branch not only to distribute within its own boundaries, but as a base for surrounding territories as well. A free port offers similar conveniences. In some countries a simple system of tariff "drawbacks" permits reshipment.

Other things to consider in selecting a site for a branch are: Cost of doing business (labor, rent, etc.); quality and supply of labor available; the standing of the town in its community, that is, how it is regarded by people both within the country and out of it, etc.

The size and scope of the branch organization depend on the sales policy. If the branch should sell chiefly through a few big distributors such as jobbers, subagents, etc., then not only are fewer salesmen needed, but less inside help. On the other hand the direct development of a large retail trade or the direct sale to many consumers add to both the inside and outside forces and to greater specialization of the work. At the outset, however, and particularly until a branch has "found itself," a small organization is generally found to be sufficient.

I might mention a form of branch organization that will be found valuable in certain instances. I refer to cases where an important or "key" country has joined smaller ones in which latter it is undesirable to establish branches. In such cases a branch may be established in the central country and may supervise the distributing system in the adjoining countries. Thus, the management of a branch in Buenos Aires could direct the policies and watch the results of agents or dealers in Paraguay and Bolivia, and even in Chile and Uruguay, until these countries would warrant branches of their own.

Personnel of Branch Organization

There is probably no single factor of greater importance than the right selection of the management of a branch. The whole success or failure of the venture depends upon it. No matter how efficiently the plans and policies of the branch may be mapped out at the home office, no matter how careful the supervision may be, it is on the initiative and execution by the management that the final results depend. The manager of a branch within the United States can call for help and advice upon the executives of the business; he can present his case fully and quickly, and the house can in judging be guided by its experience in similar cases in this country. Not so with the foreign-branch manager. He is thousands of miles away, depending entirely on that briefest of messenger, the cable, to carry his questions and bring his answers. He is facing conditions radically different from those at home, different in customs, different in standing. He can at best only apply the home policy to the actual situation as it confronts him. In nine cases out of ten he must act first and ask confirmation afterward. His authority therefore for his own territory comes pretty close to being supreme.

It is obvious what the character of such a man should be; he must be broad-minded, and have a clear grasp of essentials as well as details; he must be adaptable both to the policies of the house and the prevailing customs of the country in which he works; he must be an executive, able to handle men and women of various nationalities and characteristics; he must be a salesman able to direct the activities of others in sales work. His personality must be pleasing, particularly so for those countries where the character and personality of a man is rated above that of the organization.

Where to get such a man is a problem that must be answered according to each individual case. He may be in the manufacturer's own organization already, and if so he will be familiar with the goods, policies and aims of the house. He may be an outsider, familiar with the country in which he is to work from actual experience. He may be neither, but possessing qualities that would soon make him master of the situation.

One important thing to guard against in branch management is divided responsibility. If a man is put in charge he should be permitted to manage, free from all restrictions save those necessary for home-office control. Once appointed he should be trusted implicitly, and any occasion for lack of trust should be followed by a recall or dismissal.

His lieutenant should be selected with equal care. Someone will be needed to supervise matters in the office during his absence, and that one should be capable and have many of the qualities of the manager himself. Indeed future branch managers may well be developed in this way.

Here is another suggestion: Not only is it desirable to keep under observation in the home office one or more persons who may be usable some day for work abroad, but the foreign-branch manager should be encouraged to develop talent in his own organization, and when desirable to send it to the home office for cultivation. Many excellent employees and executives can be obtained in this way, both for the home-office export department and later as candidates for foreign work.

Do not forget also that a man who stays at headquarters too long, like a salesman who has been out on the road too long, may become "stale." A trip home and an opportunity to compare notes and talk things over will go a long way toward keeping up the morale of the branch and make for closer coöperation.

Supervision by Home Office

Just how far the home office ought to go in its supervision of branch activities is a question to be determined in each individual case. Here are some suggestions, however, of matters on which the home office should be informed and on which it may guide the branch:

Budgets.—The home office should set a mark in sales which the branch is expected to reach and should have an explanation of any deviations. This applies also to the expense budget of the branch.

Plans and Methods.—The home office should be fully informed in advance, whenever possible, of all important selling and advertising programs, as to the methods to be followed and the material to be used.

Policies.—All important policies recommended or initiated at the branch should have the approval of the home office. On the other hand it is well that the branch should have a word in the formulation of policies emanating from the home office.

Reports.—Complete reports of sales, expenditures, stock situation, etc., well analyzed, should be in the hands of the home office, not merely for the purpose of supervision but to enable it to have a complete picture at all times of the situation at the branch.

Now let us consider some of the ways in which a branch may serve. Certain of the following methods apply equally to other forms of foreign distribution; others are obtainable only from a branch:

The branch represents the manufacturer direct to the consumer, not only by advertising and the upbuilding of public good-will but by service, such as the renewal or upkeep under a quality guarantee and as assistant in the installation for use of the manufacturer's product, etc.

A branch can be made to adhere strictly to the manufacturer's trade policies—something that will be found difficult from any other selling agency.

The branch, having but a single interest and being close to the market, can be made a means of improvement in goods, service and policies.

It can watch competition closely and recommend and institute necessary measures. It can keep informed on customs regulations and sometimes even effect a saving in the rates. It can keep in direct touch with credit, using follow-ups on the ground for collection, and thus making results impossible if a manufacturer is not represented there.

Dr. Johnson once said: "I do not know that man and I hate him. If I knew him I should probably love him."

Too often the American manufacturer has been content to intrust his product and his policies to an organization of another nationality, thus missing not only the opportunity of having his proposition presented in its best form, but lacking also the direct contact that goes so far towards creating a mutual understanding which must precede good-will.

The direct communication of American manufacturers with foreign markets through their own branch offices will remove much of the misconception prevalent abroad of American methods and business efforts and will take us a long step toward the sympathetic understanding of our business aims by the people of other nations.

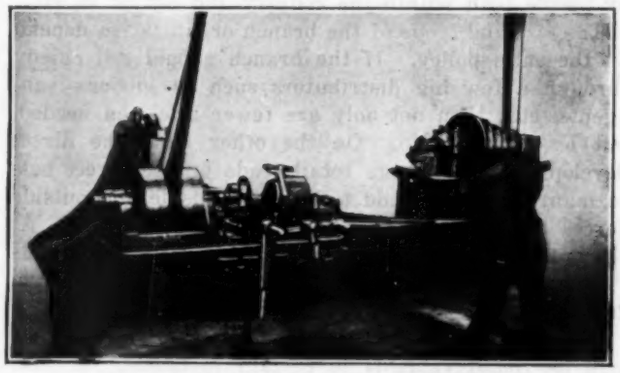
Making Use of a Discarded Machine

By Donald A. Hampson

The unprecedented demand for machine tools during the past few years has been met by greatly increased production and by utilizing to their fullest extent existing machines that were previously more or less nonproductive. Manufacturers first attempted to buy new machinery for their wants, following which, if there was still a shortage, they turned to what they already had, to second-hand stocks and to tools that had been discarded for more modern ones, endeavoring by the use of ingenious devices and conversion to single-purpose machines to make the old tools equal the production of new ones.

One of the class mentioned is shown in the cut—a horizontal boring machine that had been sidetracked years before and somehow had escaped the hand of the junk man. Brought to light and cleaned up it offered possibilities at a time when a geometric threading machine and a light milling machine promised in four months were urgently needed for Government work. The work was threading the ends of ⅜-in. rods and milling a Woodruff keyseat in one end. A search through odd parts around the plant located certain units that were rigged up as shown, and in a week's time this resurrected machine was turning out work at a rate limited only by the worker's ability to handle the stock.

The first operation is threading. A headstock formerly used on a tapping machine was mounted on



OLD BORING MILL REHABILITATED

a table that had once served on a small milling machine and a slide rest saved from a special machine was mounted at the other end. This rig was fastened to the table of the boring machine the spindle being driven by a belt, the mechanism formerly used between the pulleys for reversing the spindle answering the purpose satisfactorily. An Errington opening die was placed in the spindle, being closed by the operator's knee against the lever hanging down in front. On the slide will be seen a casting holding a Pratt two-jaw chuck that is set to align with the die. In front of the chuck wrench in the picture is a right-angle piece that is swung down for a stop to position the rods as they are gripped in the chuck for threading. The pilot wheel at the front of the slide presents the rod to the die.

After threading, the rods (which are 24 in. long) are dropped on the inclined surface to the right and they roll down to stops on what is normally the front of the boring machine. Storage is here provided for 3000 rods. In this location they are easily accessible to the man who performs the milling operation.

The boring-machine spindle is fitted up with a stub arbor to carry the keyseating cutter. Adjustment of speed is provided by the cone pulley. A guard covers the cutter. A section of a 15-in. steel I-beam was planed off on the flanges, and when bolted to the bed gave us a table within reasonable distance of the spindle. On this table are two castings, the upper one turning about a pin so that it can be moved through a small arc to allow clearance for loading, and it may be raised sufficiently to cut the keyseat to the required depth. A suitable V with clamp forms part of this casting and a handle on the far side, not visible in the cut, forms the means of feeding. The rods are shoved in until they touch the stop (seen just to the right of the main bearing) when they are clamped and milled.

Heat-Measuring Instruments

By C. E. CLEWELL

The principal types of pyrometers are here treated and some of the features connected with their use discussed, including automatic temperature control, signaling and recording, multiple recording, checking and standardizing, correction for cold junction points and methods for the detection of temperature transformation points. Typical uses are explained and numerous cases of practical installations of pyrometers are illustrated.

EARLY efforts of Le Chatelier and Becquerel led to the development of the thermoelectric pyrometer, this general type being the form widely used for measuring high temperatures. The thermoelectric pyrometer works by the electromotive force developed at the junction point of two wires of different alloys when heated. By connecting these two wires to the terminals of a millivoltmeter the rise and fall of temperature to which the junction point is subjected is indicated by a rise and fall of the instrument pointer. The general features of the so-called base-metal thermocouple are shown in Fig. 7, which indicates different stages in the construction. A completed thermocouple is shown to the extreme right.

The terminals for connecting to the millivoltmeter are also shown in Fig. 7. In Fig. 1 one of the meter parts is shown for use with thermocouples. This instrument is of the high-resistance type, and is very accurate and free from errors due to changes in the

FIG. 1. HIGH-RESISTANCE INDICATING PYROMETER

length of the wires between the instrument and the thermocouple or to temperature changes of these wires. Low-resistance instruments are not so accurate as those of the high-resistance type.

A scheme for the elimination of errors due to changes in the temperature and length of the aforementioned connecting wires is the use of a so-called potentiometer system, whereby the small electromotive force in the thermocouple is arranged to oppose a known electromotive force that in contrast to the direct scheme of measuring the thermocouple electric pressure eliminates the errors in question by the balancing action of the system.

An advantage of the high-resistance instrument of Fig. 1 and also of the potentiometer method is that a number of different thermocouples may be connected successively to the same instrument, since with these types the differences in the distances between the meter and the various thermocouples do not affect the calibration of the instrument. The early form of thermo-

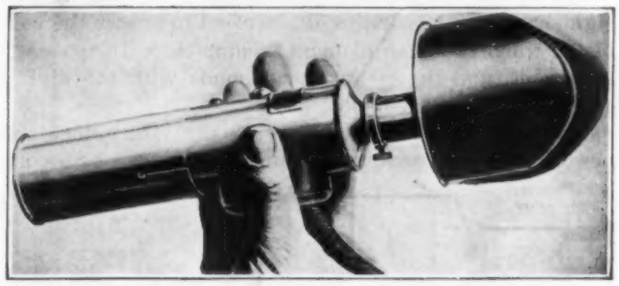


FIG. 2. OPTICAL PYROMETER

couple of Le Chatelier made use of one wire of platinum with 10 per cent. rhodium, the second wire being chemically pure platinum. These are known as "platinum-rhodium" thermocouples and are adapted to the measurement of high temperatures. Later forms employ base metals like nickel and chromium and are known as "base-metal" thermocouples. They are adapted to

FIG. 3. USING THE OPTICAL PYROMETER

the measurement of temperatures up to 1800 or 2000 deg. Fahrenheit.

The optical pyrometer is used for the measurement of temperatures up to 2500 deg. F., and makes use of the principle that the brightness of the hot object, the temperature of which is to be measured, can be matched with the brightness of a standard within the instru-

ment. Fig. 2 shows the sight box of an optical pyrometer, and Fig. 3 indicates the complete outfit, which is portable and readily handled.

Fig. 4 shows the optical system (above) and the electrical circuit (below) of this type. The electric current through a lamp may be adjusted by the rheostat until the brightness of the lamp filament matches that of the image of the hot object as a background. After this balance is obtained the milliammeter reading is observed and the corresponding temperature taken from a calibration curve which accompanies the instrument. The way in which the lamp filament merges with the image of the hot object is shown below in Fig. 5. The right-hand portion of this illustration indicates the condition when the lamp filament is supplied with too small a current, and the center corresponds with too high a current through the lamp.

Another form of pyrometer for use where the temperatures to be measured are higher than can be accommodated by the ordinary thermocouple outfit is the radiation type, in which no part of the instrument is in contact with the heat to be measured, but the radiation of heat from the hot object enters the tube of the pyrometer and is reflected by a suitable mirror to a sensitive thermocouple, this thermocouple being used in the ordinary way with an electric meter. Temperatures up to 3600 deg. F. are measurable by this type.

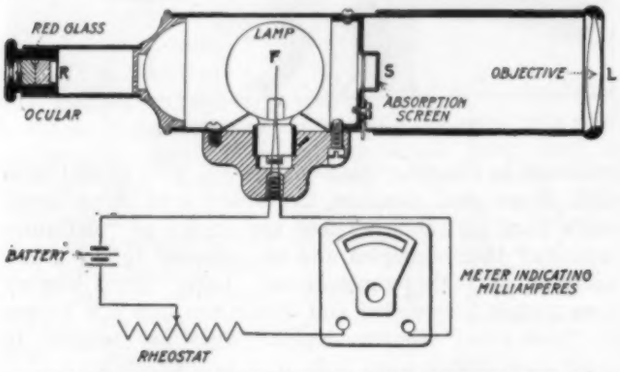


FIG. 4. ELECTRIC AND OPTICAL ARRANGEMENTS OF THE TYPE OF PYROMETER SHOWN IN FIGS. 2 AND 3

For the measurement of high temperatures up to say 3000 deg. F. with a quick-acting portable pyrometer, as in furnaces, annealing ovens, boiler furnaces and the like, the "quick-acting platinum" type, illustrated in Fig. 6, may be used. When inserted through an opening of a furnace wall a reading within a fraction of a minute may be secured even where the temperature corresponds to a white heat. After the reading is taken the pyrometer is withdrawn, and when cold it is ready for a second measurement. About 20 min. are required for the instrument to cool after taking out.

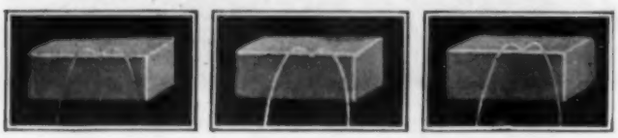


FIG. 5. COMPARISON OF LAMP FILAMENT WITH THE IMAGE OF THE HOT BODY

Other available types or modifications of the foregoing include the mercurial pyrometer in which the general principle of the low-temperature thermometer is employed, except that nitrogen, under pressure, is used instead of a vacuum above the mercury. Temperatures up to 1000 deg. F. may be measured by such instruments. The "expansion" pyrometer operates on the principle of the different expansion of rods of graphite and the stem of steel which incases them. This type measures temperatures of 800 to 1500 deg. F. and while not as accurate as the thermoelectric type it will stand hard usage.

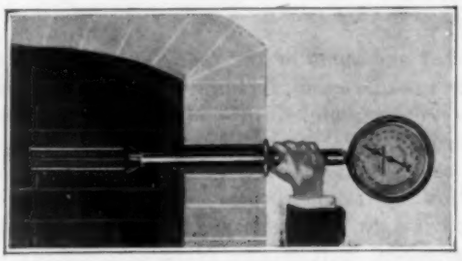


FIG. 6. QUICK-ACTING PLATINUM PYROMETER

One of the promising fields for development in pyrometry is that of automatic temperature conrol in furnaces for heat treatment and other purposes. This is accomplished by the direct operation of valves, dampers or rheostats by a pyrometer recorder, or it may be done by the opening and closing of auxiliary circuits which operate the valves or dampers indirectly, according to the electrical-relay principle.

One type of automatic temperature-control pyrometer is somewhat like the high-resistance indicating type (Fig. 1), but the pointer in this case is made to press down upon a contact at short time intervals by a small motor. The pointer itself does not conduct current for actuating the relays, but merely brings two contacts together, the latter completing an electric circuit and allowing a current of a fraction of an ampere to flow. This small current operates the relay which causes the valve to operate. With a range of 1600 deg. F. it is possible to control the temperature within 8 deg. above or below a given point.

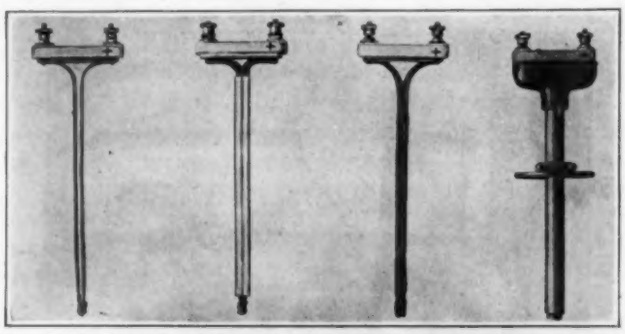


FIG. 7. BASE-METAL THERMOCOUPLES

With this type a meter of the high-resistance form is used in conjunction with a thermocouple either of base metal or of platinum-rhodium. Another type employs a thermocouple with a potentiometer as previously described, the latter having an adjusting device similar to that of the curve-drawing form of the pyrometer.

An application of the scheme for automatic control of furnace temperatures is the automatic signaling that can be accomplished between a control pyrometer and given furnaces. The older method was to station an operator at the central pyrometer, whose duty was to

signal by red, white or green electric lamps at the furnaces whether the temperature was too low or too high within the prescribed limits.

By the use of the same general contact scheme em-

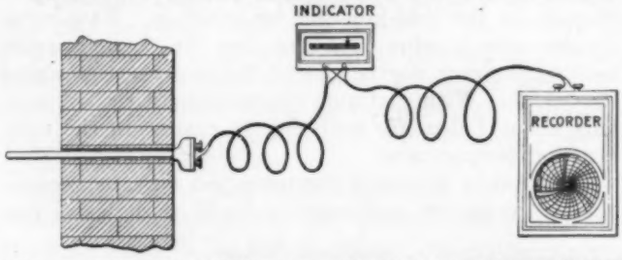


FIG. 8. INSTALLATION OF A THERMOCOUPLE THROUGH A FURNACE WALL

ployed in the automatic control equipment the signals may be given automatically, thus not requiring an operator at the central pyrometer. In one apparatus for this purpose the electric current that operates the signal

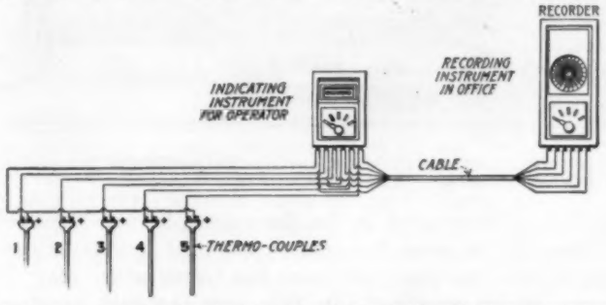


FIG. 9. ONE INDICATING AND ONE RECORDING INSTRUMENT USED FOR A SERIES OF THERMOCOUPLES

lamps does not pass through the meter itself, but is allowed to flow or is interrupted by the relay principle, thus relieving the contactors in the meter from carrying more than a small current and avoiding sparking.

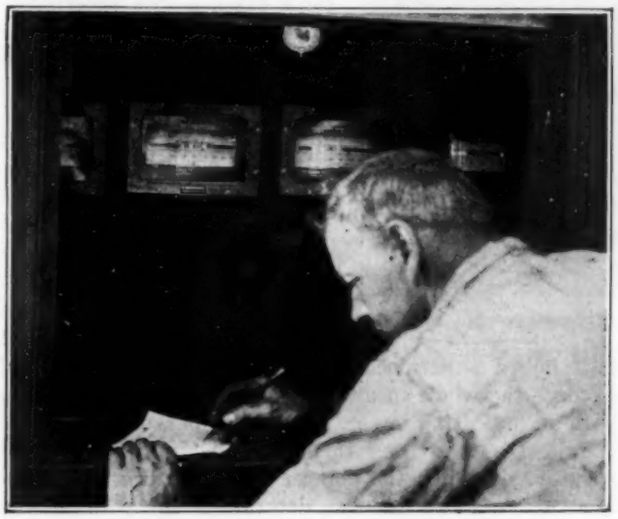
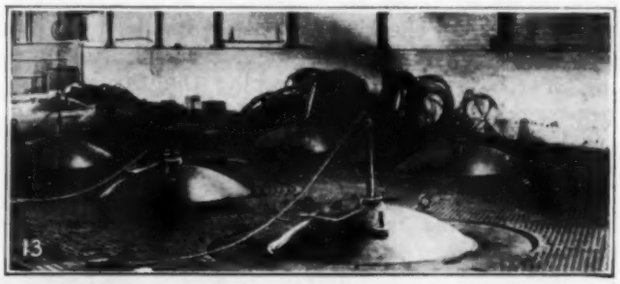
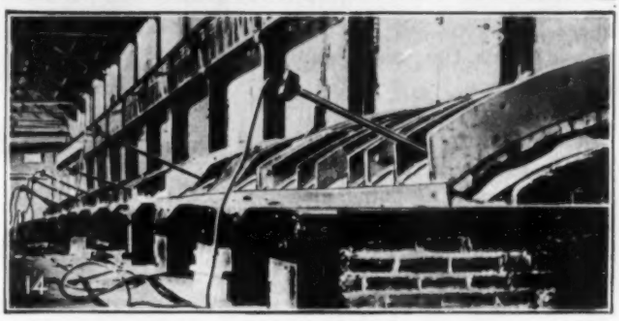


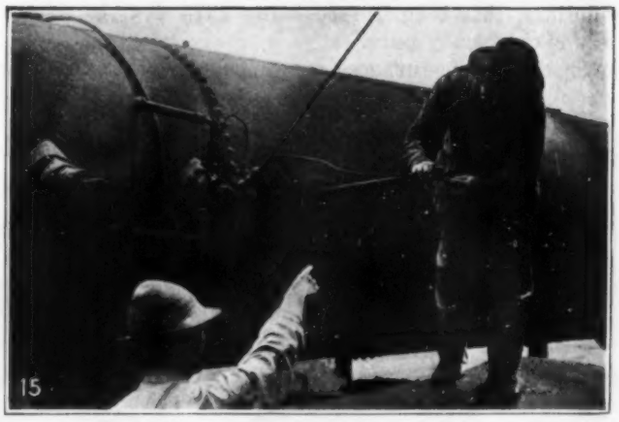
FIG. 10. INDICATING PYROMETERS AT A FURNACE. READINGS TAKEN THROUGH WINDOW

It is possible also to indicate the temperature or the degree of its variation at the furnace instead of the use of lamps for low and high indications. For this purpose a modified type of one outfit employs a slide wire instead of the three contacts where lamps are depended upon. This slide wire receives current from an outside source, and an ammeter at the furnace is so connected to the slide wire at the central pyrometer that its needle rises and falls with the furnace temperature. The furnace-temperature meter is calibrated to read in temperature degrees directly. A combination of lamps and an ammeter may also be used if desirable.

The recording pyrometer serves as a convenient means for following temperature changes by the fur-







FIGS. 13 TO 15. USING AND INSTALLING THERMOCOUPLES

Fig. 13—Using base-metal thermocouples in pot-annealing furnaces. Fig. 14—Thermocouples used to measure and record temperatures at a number of points in a large furnace. Fig. 15—Installing a thermocouple in a hot blast.

nace operator and provides a permanent record for reference.

In the curve-drawing recorder a record of temperature is made on a moving paper roll by a pen in the form of a continuous line, while in the multiple-point printing type the record consists of a series of dots with a number adjacent to the dot corresponding to the thermocouple in use at the particular instant. In another type the readings of from two to eight thermocouples may be recorded on one sheet, different colors being used for the dots. This makes it possible for individual records to overlap without confusion. In some types of recording instruments for single thermocouple records circular or continuous roll charts are employed, in which it is possible to secure either parchment or

paper records, the former being used with a piece of carbon paper behind the parchment so that the record is made on the back of the parchment by the carbon paper. The continuous-roll feature has the advantage of long interval use, it being possible to keep a single record over two months without renewal of the paper.

For the purpose of standardizing the pyrometer equipment from time to time several schemes may be used. One of these is to keep on hand a standard thermocouple for checking up those in regular use. The standard couple is placed in the furnace and the reading of the meter noted. Keeping the furnace temperature constant the connecting leads from the meter are now changed to the thermocouple under test, and the readings on the meter will thus show immediately whether there are any differences between the standard couple and the one being checked.

Another plan is to use pure salt for calibration by merely raising the temperature of the salt to the melting point, placing the thermocouple to be tested in the melted salt, after which the temperature of the salt is permitted to fall. As the salt cools it is possible to obtain a reading at the point where the salt solidifies, this temperature being 1474 deg. F., if the salt is chemically pure.

Small electric furnaces are of value in this checking work and can be obtained with suitable control of the temperature over a wide range. The usual procedure is to insert the test couple in such a furnace when it is uniformly heated and to place beside the test couple a standard couple, the two being fastened together. This is a manufacturer's method of calibration, but it can be adopted by the shop as a practical measure.

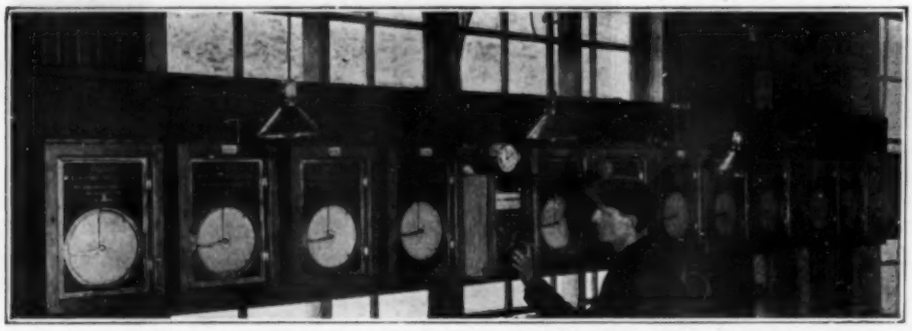


FIG. 11. TWELVE HIGH-RESISTANCE RECORDING PYROMETERS

The electric pressure produced by a thermocouple depends not only upon the temperature of the hot junction within the furnace, but also upon that of the outer, or cold, junction to which the meter is attached. In other words this pressure is a function of the difference of the temperatures of hot and cold junctions, and hence the constancy of the cold-junction temperature is a factor in the accuracy of the thermocouple equipment—a higher temperature of the cold junction than that for which the outfit is adjusted means that the actual readings will be low and vice versa.

By adopting some given temperature for the cold-junction point, say 75 deg. F., it follows that when the hot junction is not heated the meter should indicate this temperature, and it is possible then to correct for changes in the cold-junction temperature. Base-metal couples give a value of 1 deg. low for the pyrometer reading for each degree rise of the cold junction above 75 deg. F. With platinum thermocouples the error is only about ½ deg. for each degree change in the cold-junction temperature.

Other ways in which compensation may be secured are by the use of compensating leads of the same materials as those used in the thermocouple, which makes it possible to place the cold junction at a greater distance from the furnace where the temperature may be more nearly constant. In this way the cold junction may even be placed in the ground at a depth to insure practical temperature constancy at all times. Compensation boxes are also available for the same purposes where greater accuracy is required.

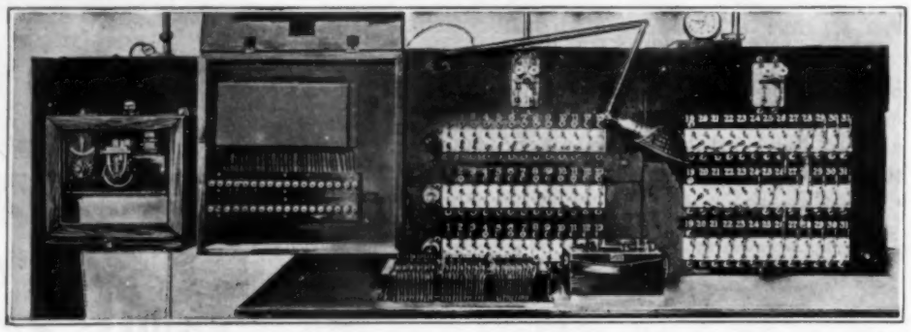


FIG. 12. EIGHT-POINT THERMOCOUPLE RECORDER FOR CONNECTION TO ANY EIGHT OF 31 DIFFERENT THERMOCOUPLES

One other feature in pyrometer operation that is of considerable importance in some cases is the determination in advance of the proper furnace temperature to use for each grade of steel. This concerns the changes which take place in steel at temperatures known as transformation points; that is, the points of decalescence for rising temperatures and of recalescence for falling temperatures. To determine these points in advance one method is to imbed a thermocouple in a sample of the steel and to place the whole in an electric furnace in conjunction with an indicating meter. As the temperature rises, the operator, by watching the meter and noting the temperature at which the pointer ceases its upward movement for a short interval, determines the point of decalescence. A more accurate determination can be made by the use of a recording pyrometer which automatically makes a record from which the transformation points are obtainable. The differential couple may also be employed, which in one equipment consists of two pieces of platinum joined by a short section of platinum-iridium alloy. One junction of this couple is placed in contact with the steel sample and the other with a neutral body. This form of couple has the advantage of

producing a high electric pressure that changes at a nearly uniform rate as the temperature of the furnace changes.

A general idea of the methods of pyrometer installation may be gained from Figs. 8 and 9. In the former a thermocouple is shown installed through a furnace wall with attachments both to an indicating and a recording meter. The latter is a case of one indicating and one recording meter used in common for a series of thermocouples.

The convenient location of the meter elements of a series of thermocouples at one central location is illustrated in Fig. 10. In Fig. 11 twelve high-resistance recording pyrometers with the circular form of charts are shown as employed in an ammunition plant.

Multiple recording is illustrated in Fig. 12 where an eight-point thermocouple recorder is employed in such a way that any 8 out of 31 different thermocouples may be connected to the meter shown in this illustration.

Fig. 13 shows a method of installing base-metal thermocouples in pot-annealing furnaces; Fig. 15 shows the installation of a couple in a hot blast, and Fig. 14 brings out how a number of thermocouples may be used to measure and record the temperatures at any number of points in a long furnace, thus giving the operator continuous information as to how the temperature varies at the different parts of the furnace.

The great practical importance of these instruments in the various heat measurements and for control purposes is apparent from the wide uses of such apparatus suggested by these views, and the complete developments of the many types on the market is naturally of great value to the art.

The Welding of Steel*

By B. K. Smith
United States Welding Co.

The question of steel welding is one of the most important of all the problems which confront the oxyacetylene welder. A large part of this problem has to do with his knowledge of steels and his habits of handling the blowpipe in steel welding. The welding in itself is apparently one of the most easy to obtain, and the misfortune is that some welders are considering steel welding as a subsidiary problem of their trade and are passing it with a light heart because their welds look so well. Yet steel welding, notably in boiler welding, requires the most careful thought and should be studied not only from the practical point of view but also from the theoretical.

What are the enemies of steel welding? Or what shall we study so we can become proficient? The enemies of steel welding are (1) the incorporation of iron oxide, (2) the thermal disturbance in the vicinity of the weld and (3) the expansion and contraction problems. Therefore one needs to study, first, the technique and properties of various steels; second, the phenomena produced during the melting of the metal under the oxyacetylene torch, and third, boiler construction, or expansion and contraction.

If one has the above knowledge in a sufficient degree the welding in itself will be comparatively easy and successful; but if he has not, and failures or accidents occur to him, he will believe and insist that certain operations are impractical or impossible to perform with the oxyacetylene blowpipe. This is one of the reasons why certain companies will not trust the apparently good-looking welds and reserve to themselves the right to sanction or forbid boiler or pressure welding.

In studying the first problem of the incorporation of iron oxide in the weld one must know what iron oxide is and what it looks like. Iron oxide is a burnt element created on the surface of molten steel under the action of the blowpipe and the atmospheric oxygen. The appearance of it is like white veins and foaming spots.

In the early days when I found that my good-looking welds failed immediately or six months later I thought that this oxidation was an uncontrollable enemy in the welding trade, and was ready to drop all welding on pressure vessels. Still inwardly my conscience told me that there was a remedy, and that I needed to study the anatomy of steel as the surgeon studies the anatomy of the human body before he commences to weld the human limb.

Iron oxide will dissolve into the molten steel at the rate of a little higher than 1 per cent., and in this reaction it may destroy the carbon elements with the result of a decrease in the strength and elasticity of the weld.

Steel Welding

The best way to reduce oxidation is to lower the oxygen pressure as much as possible—just enough to produce a free and soft flame that will produce a continuous melting without running over the edge, or in plainer words a melting without too much exaggeration. This operation depends largely on one's blowpipe and the flame maintained throughout the weld.

With a proper flame one will notice the flow of the metal clean and regular, but with a too rigid flame that requires more oxygen one will notice white veins and foamy spots flowing in the molten metal. These are streaks of oxide of iron, and they will dissolve and create new ones with the progress of the weld. The molten metal is swept rather than laid in formidable clean layers, and in some cases the metal is adhered instead of welded.

Oxide of iron cannot be altogether eliminated from any kind of weld as long as we cannot protect it from the effects of the atmosphere, but it can be so decreased from the interior of the weld that its contents would do no harm to the strength of the weld.

Another way to decrease oxide of iron is to use a good and well-known blowpipe that will deliver a normal flame and consume about an equal proportion of oxygen and acetylene. Reliable regulators and strong gages will also help to maintain a continuous, steady and normal flame. The welding rod must be a clean, soft charcoal or electrolytic iron if good results are desired.

Some of the men who are known as experienced welders and who have been welding probably for five or six years, but who have met with some failures in steel welding, will not admit that the main cause of failure is the improper regulation of the flame. Why? Because the regulation of a welding flame is the very

*Paper read at the regular monthly meeting of the Northwestern Welders' Association, Minneapolis, Minn., Oct. 9, 1918.

beginning of the study of oxyacetylene welding. It would be the same as if a college student were compelled to return to the first grade to learn his A, B, C. Yet it is so.

Most of our welders, having previously mastered some other craft, have begun welding important operations without any preliminary instructions. In other words, they began at college without having a primary and high-school education, which is the foundation of any student or craftsman.

What would a boilermaker think if a novice tried to put in a set of flues in a boiler? Or a machinist if an apprentice would make a set of dies? Yet the same boilermaker or machinist approves and looks upon the welding of blowpipe as a part or helping instrument to his trade and that all he needs to do is to go ahead and weld.

In studying the second problem about the thermal disturbance that is produced by the gas flame on the metal when it is raised to a fusing temperature or, in other words, the considerable change in the growth of crystals that will set in in the vicinity of the steel weld, it appears that the agent that causes this trouble is heat. However, we must not forget that it is heat which created the birth of many new steels, and while heat can be employed to increase the life of metals it can also reduce and destroy their life and strength. Therefore if this agent is at our disposal it remains for us to study how we shall employ it so as to obtain the best results.

Structure of Gas Weld

It is well known that the structure of any gas weld at the welding line, on a boiler plate for instance, is a cast metal. This cast metal is much lower in elongation than the boiler plate. Yet the structure of the boiler plate was originally at the mill a cast metal or something similar to the gas-welding line of metal. But it has been refined by the operations of heat and mechanical treatment to a strong metal that we call boiler plate.

The question is then, Can we employ the heating agent with the aid of the gas blowpipe to refine the grain at the weld and its vicinity? My answer is "Yes, provided the operator knows the physical and the chemical properties of boiler steel."

In studying the third problem of expansion and contraction there is no longer such a thing as not being able to take care of expansion and contraction in steel welding, and the methods of solving this phenomena are great and interesting.

In boiler welding one will find these problems difficult to solve unless he has a full knowledge of boiler construction. Yet the effects of expansion and contraction are less feared by some boiler welders because the metal to be welded possesses the property of elongation. However, my advice is that no welder should depend on the fact that the metal will give and that a little strain will not hurt the weld, for two reasons: First, because in almost all cases an intelligent welder can find a solution of how to take care of the expansion and contraction, and second because no human being can know how much of a strain is left in the metal. It may be very little or it may be to the breaking point. Such a weld may crack during the progress of a weld or a few days or even six months after. At any rate the welder is not excusable and the failure will condemn the operator, the process and the whole industry.

There is one point that an oxyacetylene operator must bear in mind, and that is to make a strong weld. Economy should be considered as secondary. While there must not be any useless waste in time or material, it must not be forgotten that a defective weld is a waste of time and material.

Rules for Insuring Failure in the Drafting Room

By S. M. Ransome

1. Always have a few mistakes of omission or commission in your work—the checker or inspector is paid to find mistakes.

2. Don't trouble about too much neatness or accuracy in your work. What's the use?

3. Never do more than you are actually told to do in quantity or quality.

4. Never study anything at home—you might get a headache.

5. Develop a permanent grouch toward your job, your boss, the factory and, if possible, the world at large.

6. Consider yourself the equal of any and the superior of most.

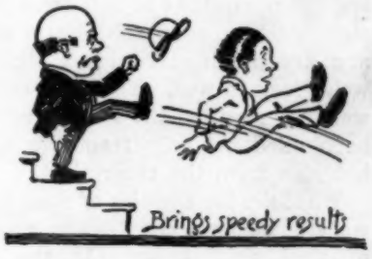
7. Don't bother too much about punctuality—it's an old-fashioned idea to be always on time.

8. Consider yourself first, your associates second and your employers third.

9. Any time you feel like taking a day off take it; the rest can manage for one day.

10. If you want a raise in wages or change of work don't ask your immediate superior; go to somebody higher up. This will cause your own chief to think very warmly of you.

11. Never hurry on a rush job—there is probably no real need for it anyway.



12. Utilize your working hours to rest up, visit and plan your private affairs. "In time of work prepare to play."

13. Utilize your free hours to unfit yourself for work.

14. As to personal appearance be either a frump or a fop.

15. When a hard job looms up, or extra responsibility, or blame for errors, duck, and duck quick! A good boxer can always sidestep.

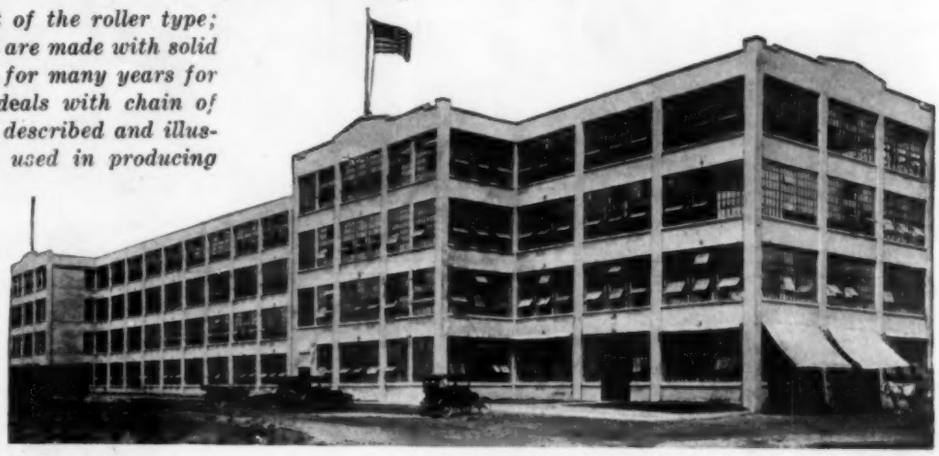
16. Having carefully observed some or all of the foregoing hints go to your boss and demand a raise—this will almost invariably bring speedy results.

17. Get another job if possible, and repeat. You can be assured of early and complete failure.

The Manufacture of Diamond Transmission Chain

BY J. V. HUNTER, Western Editor *American Machinist*

All transmission chain is not of the roller type; millions of feet of light chain are made with solid blocks such as has been used for many years for bicycle drives. This article deals with chain of the latter type, and in it are described and illustrated some of the methods used in producing the blocks and pins which enter into its construction.



Part III. Making Block Chain

THOSE who have been familiar for years with that type of bicycle drive chain which has solid center blocks may be interested to know that this block replaces two rollers, two bushings and two inside connecting side links, six parts in all. The blocks have been made of different kinds of stock, the most familiar being the elongated O, the B, and the figure 8 bars.

Millions of feet of block chain are produced annually, the material for the blocks being in the form of cold-rolled or die-drawn bars 8 ft. to 10 ft. in length.

SAWING BARS

The first operation is sawing these bars to suitable lengths, depending upon the width of the chain to be produced. This is done by sets of cutters on a single arbor in milling machines of the type shown in Fig. 22.

For sawing, the stock is clamped in a suitable fixture *A* mounted on the feed table *B* and fed forward against the cutters, of which there may be as many as 28 on an arbor at a time.

The drive on this machine is worthy of attention, since the customary leather belt has been replaced by roller chain between the line shaft and the machine, and may be noted at *C* in the upper left-hand corner of the illustration.

The use of chain in this place has been found more satisfactory than belting. For years trouble has been experienced with the breaking of the cutters, the cause for which was finally attributed to the slipping of the belt. The cut required is heavy, causing the belt to lag or slip when the cutters come in contact with the work, which results in an unsteady and jerky motion.

The use of chain drive has shown that steady, positive motion can be maintained on the cutter at all times, the result of which being that breakage has been reduced to less than 10 per cent. of that in the former method of drive.

A heavy stream of lubricant is kept flowing over the cutters. The feed pipe shown at *D* delivers the lubricant into a sheet-metal spreader hood, which in turn distributes it uniformly over the cutters. At the left is a small funnel used for pouring solution into the pump as a primer when starting the machine.

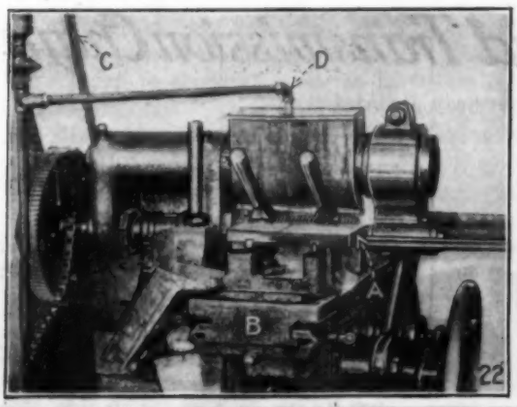
Fig. 23 is a closer view of the fixture and shows the two handles *A* for clamping the bar stock. The sawed-off sections are pushed to the left and fall down the chute *B*. Two of the sections are shown at *C*, and a short piece of the stock at *D*, while at *E* is the bar stock that is being operated on.

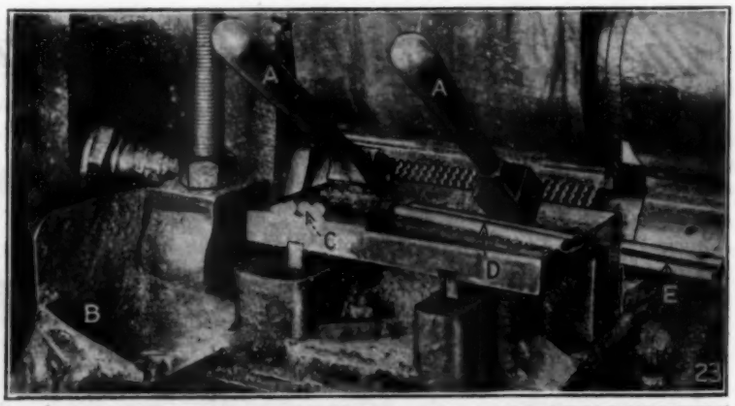
The next operation is to drill a hole in each end for the pins that connect them to the side links. The drilling is done on automatic drilling machines that are fed with links from magazines. The magazines used are shown in Fig. 24 at *A*, and one which is being filled is shown at *B* with one end projecting into the filling machine at the right. The blocks are poured loosely into the funnel *C* at the top of the machine, which by a jolting action causes them to fall into a tube down which they slide to the base of the machine. Here a ram in the position *D* pushes them into line with the magazine tube and another ram at the back thrusts them into the tube. When the tube is filled the operator removes it to one of the drilling machines.

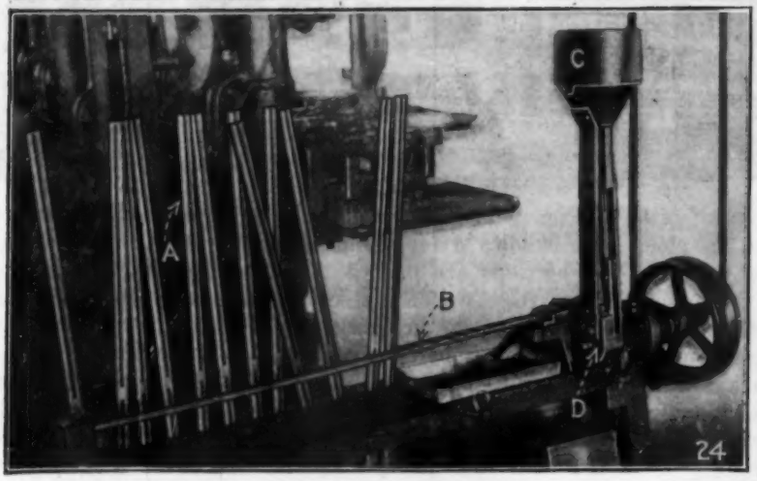
DRILING BLOCK ENDS

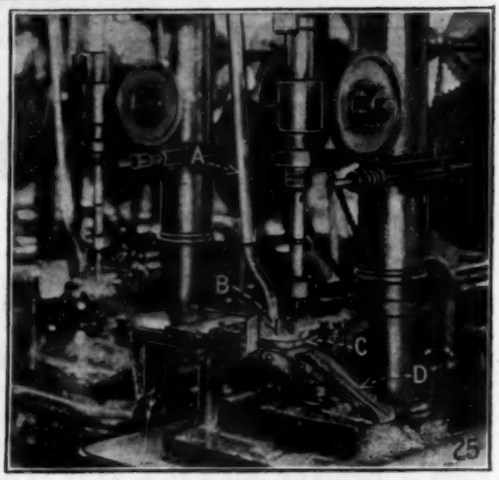
One of the machines used for drilling the holes in the block ends is shown in Fig. 25. The magazine feed tube *A* terminates at a feed plate at *B*. At this point a small ram from the rear catches the bottom block in the tube and pushes it forward to a point about at *C* where it comes beneath the drill. The drill jig which holds the connecting link is pivoted, and after the first hole has been drilled the spindle is raised and the jig, timed by a chain drive, is swung to a second position, which brings the other end directly under the drill. At the conclusion of the second drilling the block is automatically ejected, the jig returned to its original position for drilling the first hole and a fresh block substituted. The finished piece slides down a chute *D* at the right, falling in the pan as shown.

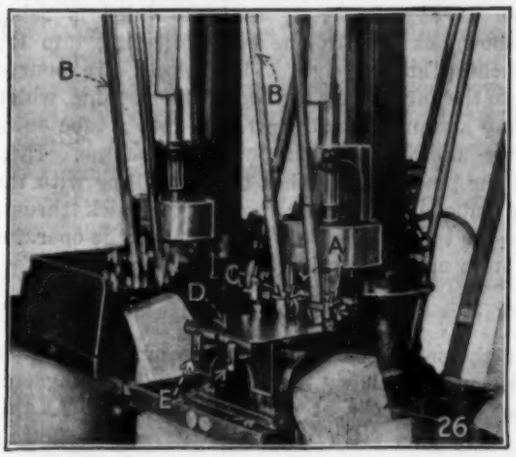
To insure accuracy the holes are reamed on the machine shown in Fig. 26. The machine handles two blocks simultaneously, reaming both holes in each so there are four reamers *A* in service. For handling the blocks they are strung on wires at *B* on which they slide down into a chute at *C*.

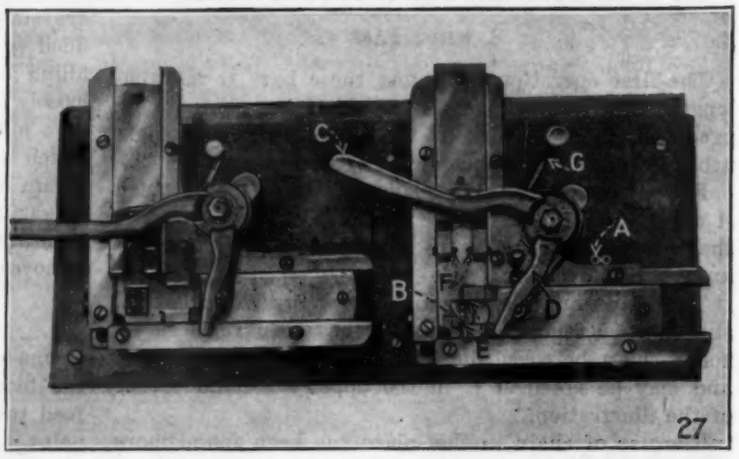


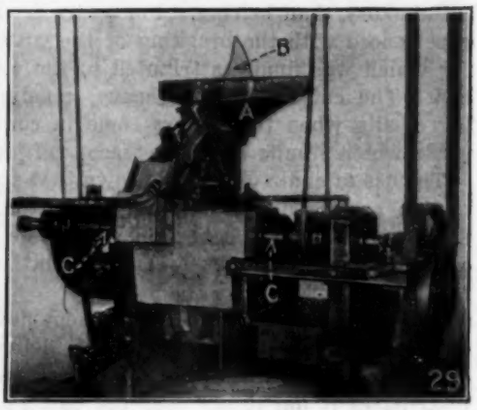












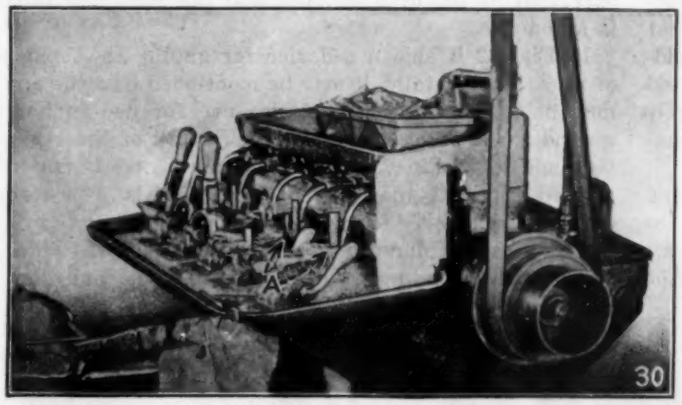
FIGS. 22 TO 29. MACHINES FOR MAKING BLOCKS AND PINS

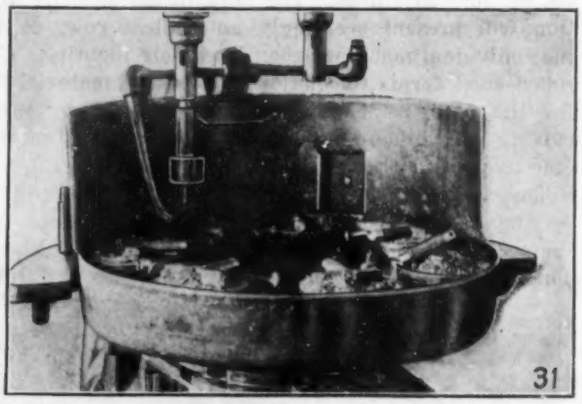
Fig. 22—Machine for cutting off center blocks. Fig. 23—The fixture and the saws. Fig. 24—Machine for filling magazine tubes. Fig. 25—Automatic machine for drilling center blocks. Fig. 26—Reaming holes in center blocks. Fig. 27—Device for gaging center blocks. Fig. 28—A few of the automatic screw machines. Fig. 29—Automatic machine for finishing ends of pins

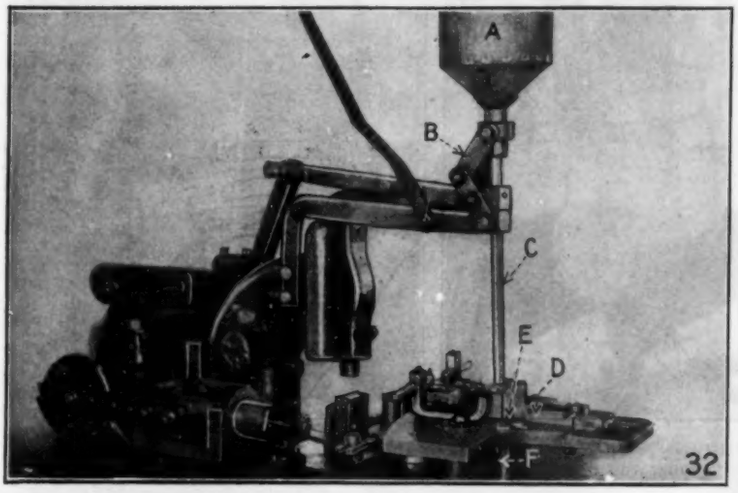
Beneath the cover plate *D* of the table are two cam-operated rams, the outer ends of which may be seen at *E*, which are timed so that after the holes have been reamed the finished pieces are ejected and fresh blocks supplied. One operator usually tends from three to four of these machines at a time, the wires

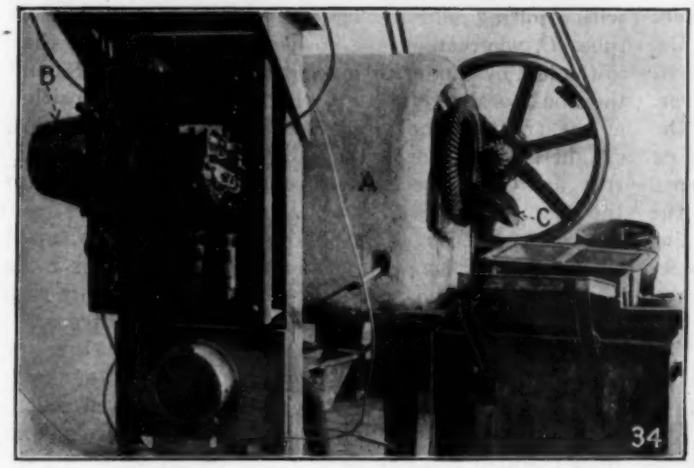
links is shown in Fig. 27. The piece to be gaged is shown at *A*, and for gaging it is slipped on the pins *B* which gage the diameter and hole spacing.

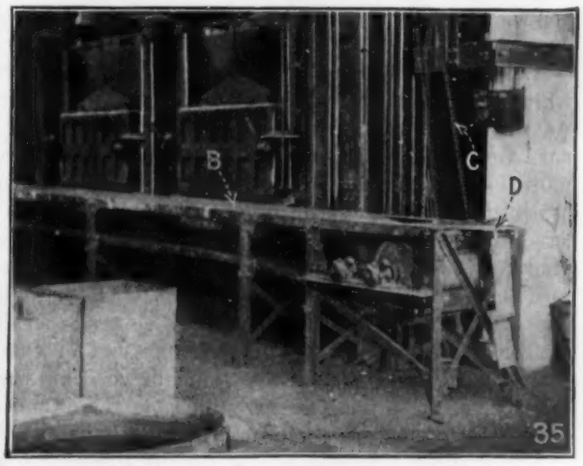
Pulling the lever *C* backward throws the lever *D* to the left, which moves the jaw with the gaging points *E* past the ends of the link, thus insuring it is not too











FIGS. 30 TO 35. DRILLING, GAGING AND TEMPERING PINS

Fig. 30—Drilling cotter holes in pins. Fig. 31—Drilling machine with rotating carrier. Fig. 32—Automatic pin-gaging machine. Fig. 33—Inspector gaging pin diameters. Fig. 34—Electric tempering furnace. Fig. 35—Case-hardening furnaces

being filled by a device that will be described in connection with the assembling operations and delivered to the operator who has only to attend to the machine.

All links are subjected to a rigid inspection to insure accuracy of size. The unique device used for simultaneously making three gaging operations on these

long. The motion on the handle *C* is then reversed, which causes *E* to retreat, and brings the gaging points *F* forward until they pass over the two sides of the link, thus gaging it for width. The gaged piece is ejected from the pin by pushing down the thumb lever *G*.

After these gaging operations the blocks are taken

to the hardening rooms for treatment before they go into the assembling operation.

A battery of automatic screw machines is devoted to the production of the pins required at the ends of each link of transmission chain. Fig. 28 shows only a small portion of the floor on which there are about 400 of these machines. The view in the opposite direction will present seemingly an endless row, so that the individual machines soon lose their identity. Cold-rolled steel forms the major part of the material used for the pins, some of which are finished by merely cutting off, while on others each end is reduced in diameter to form a shoulder.

The small tit left on the center of each pin end by the parting tool is objectionable, therefore it is removed by the automatic machine shown in Fig. 29. This machine has a self-feeding device located in the hopper at *A* into which all the small pins are loosely dumped.

Rising and lowering in the hopper *A* is the part *B*, which has a groove in the edge toward the observer. As part *B* lowers the grooved edge falls below the surface of the pins piled in the hopper, and one or more is sure to fall and lie lengthwise in this groove. When the part *B* again rises the pins lying in the groove slide along it, going lengthwise into the magazine that feeds the machine, and so are arranged in proper position with the feeding mechanism. The spindles *C* that feed toward one another carry cutters for simultaneously burring off the tit on each end of the pin.

The large sizes of pins for truck-drive chain have a spun rivet head on one end, and on the other is a hole for a cotter pin to secure the side links.

For drilling the hole in one end of the pins a horizontal five-spindle drilling machine, Fig. 30, is used. In this machine the pins stand on end in special clamping jigs at *A*, and are fed to the drills automatically. The jigs do not all handle the same size of pin at the same time, and it will be noticed that the foremost one in the illustration is considerably larger than any of the others. This reduces the number of jigs required and permits manufacturing operations to be carried along simultaneously on several sizes of pins.

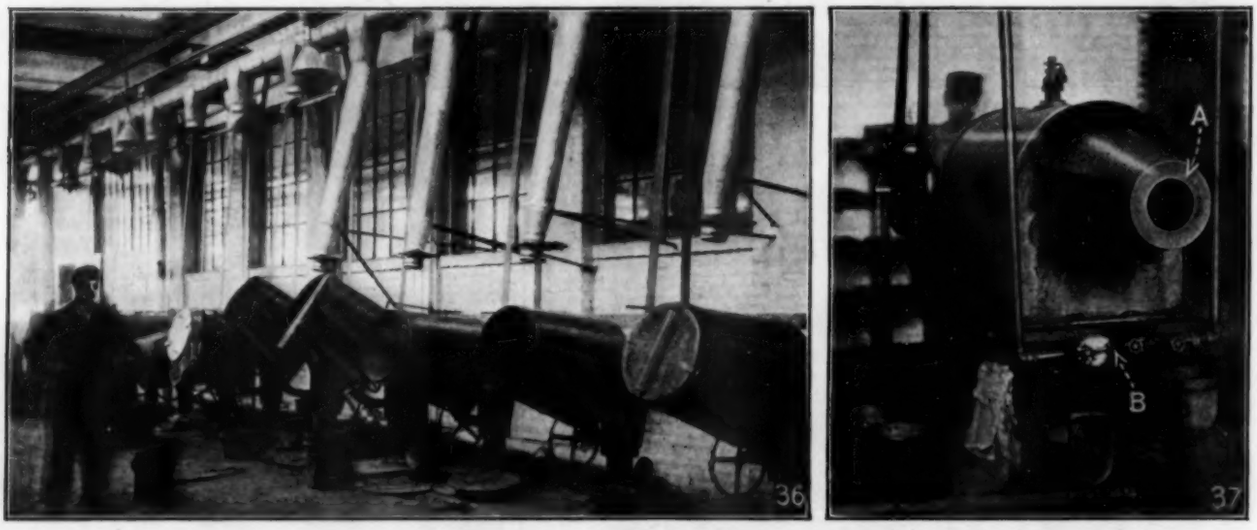
Another machine for drilling pins is illustrated in Fig. 31, in which there are seven individual jigs mounted on a revolving table. The machine has two spindles which operate simultaneously, and the operator removes the drilled parts and replaces them with fresh pieces during the time the drills are operating. The operation of the drill spindles and the revolving table is automatic.

In Fig. 32 is shown a device for gaging the lengths of pins. Incidentally, it may be mentioned that the pins now being gaged in this device are for use in hand grenades. It is necessary that the length of these pins be made to within very close tolerance, and I was informed that this device replaced 12 girls who were previously employed in gaging the pins.

The pins are dumped into the hopper at *A*, which, by the toggle arrangement *B*, is thrown up and down with a jolting motion. The pins fall down the magazine tubes *C*, where they are pushed to the right and then to the left by the operating punches or rams *D*. Should they be too short they are thrown out in the position at the front of the block *E*, and if too long they are caught by the gage at the back of this same block. If they are O. K. they pass through and drop down into the chute *F*.

Some of the larger pins and bushings must be passed by inspectors, mostly women, who submit each piece to a maximum and minimum gaging. A vertically supported limit gage, Fig. 33, is used for this purpose.

Every part that enters into the manufacture of Diamond chains is subjected to some kind of heat-treating process. All of the small bushings and rollers that are used in the lighter types of chain are placed in perforated cylindrical cans and immersed in a bath of molten cyanide for 15 min. After quenching they are tempered to a light straw color. An electrically heated furnace, Fig. 34, is used for this process. The main body of the furnace is within the heavy coating of insulation shown at *A*, and is continuously rotated by means of the gear drive shown, so that the pieces within it are continually being tumbled over one another in order that they may be uniformly heated. The charging end of this furnace is the hopper at *B* to



FIGS. 36 AND 37. TUMBLING BARRELS AND BLUING FURNACE
Fig. 36—Tumbling barrels for cleaning and polishing. Fig. 37—Furnace for bluing

the left of the switchboard. This hopper has a little compartment arrangement that picks up a few of the parts at each revolution and starts them on their trip through the furnace. When they emerge from the chute at *C* they have been heated to the proper temperature so that they come out in an even pale-yellow color and drop into the pan provided for receiving them.

The switchboard for the temperature control of the furnace is seen in the foreground with a temperature-control pyrometer mounted below the panel.

All of the pins and bushings used in truck and heavy-transmission chains are casehardened. They are packed in small cast-iron pots about 6 x 8 x 6 in. in size, being placed between layers of carbonizing material, and the tops of the pots are well luted with fire clay.

The pots are charged into the furnaces, Fig. 35, and when the heating period has been completed they are withdrawn by long hooked rods onto the movable platform *B*, which is a short steel chain driven by means of a motor through the drive chain *C*. This carries the pots to the end platform at *D* where the cover is quickly removed and the contents dumped through a screen that separates the carbonizing material from the parts which fall into large perforated cylindrical containers so that they may be more readily withdrawn from the cooling vats after quenching.

After casehardening, the parts are tumbled with sawdust in the tumbling barrels shown in Fig. 36. The parts come from the tumbling barrels clean and bright and are taken to the tempering room where the temper is drawn to the required degree.

The larger parts are blued in oil-fired revolving furnaces, shown in Fig. 37, the burners being at *B*. This photograph shows the hopper at *A* which, like the electric furnace, is equipped with a small pick-up device in the chute that feeds the parts into the furnace at each revolution where the temperature to which they are subjected gives them a beautiful blue color.

Business Advantages of Acceptances

While we have published several contributions regarding the various phases of trade acceptances the following article presents the subject so clearly and comprehensively that it will be worth anyone's time to read it, whether he be shop foreman or office executive. The article is an address by William G. Avery, assistant treasurer of the Guaranty Trust Co. of New York, that was delivered before the Bridgeport, Conn., chapter of the American Institute of Banking Oct. 22, 1918.

THE value of the acceptance as a means of improving the general character of business is becoming more and more evident through the instrumentality of the various interests that have within the last year or two devoted considerable energy to advocating its use.

The Federal Reserve Board definition of a trade acceptance is very clear and explanatory: "An unconditional order in writing addressed by one person to another, signed by the person giving it, requiring the person to whom it is addressed to pay at a fixed or determinable future time a certain sum in money to the order of a specified person. The bill must be drawn by the seller on the purchaser of goods sold and accepted by such purchaser."

How a Trade Acceptance Is Created and Used

To give an example of the creation and negotiation of a trade acceptance: A firm in Chicago buys from a firm in New York goods amounting to $50,000. When shipment is made the New York firm will draw a 90 days' sight or date draft (according to the terms of sale) on the one in Chicago, sending it to the latter with the invoice and bill of lading of the goods. This is the usual form of draft, bearing, however, the clause, "The obligation of the acceptor hereof arises out of the purchase of goods from the drawer." The Chicago concern will then accept the draft by writing across the face of it, "Accepted—Payable at the First National Bank, Chicago," dating and signing such acceptance and returning the accepted draft to the selling firm in New York.

This is now a trade acceptance and falls due for payment in Chicago 90 days from the date of the acceptance or, if it is drawn "after date" instead of "after sight," 90 days from the date of the draft. It is also eligible for rediscount with the Federal Reserve Bank by the holder. The New York firm now holds the obligation of the Chicago company to pay $50,000 on a certain date, which obligation arises out of the purchase of goods, therefore falling under the definition of the Federal Reserve Board. If the New York house requires the use of the funds represented by this acceptance it will take it to its bank, after scrutinizing the names thereon, which will purchase it from the firm at the market rate of discount and in turn rediscount it with the Federal Reserve Bank, should it become necessary, or hold it until maturity as part of their surplus reserves.

Financial Elasticity Without Inflation

From this it will be seen how the trade acceptance creates an elasticity in the finances of the country without undue inflation. Under such conditions the credit created by the acceptance is inevitably governed by the actual volume of business transacted, as an acceptance, to be eligible, can only be given for a current transaction, not for an overdue debt. This fact constitutes the chief distinction between a trade acceptance and commercial paper.

Commercial paper—promissory notes—may be purely financial or may represent very much overdue debts; in other words frozen credit. In these times it is absolutely essential that the country's resources shall be in the most liquid form possible and at the same time be on a stable basis. Billions of dollars are and have to be raised in loans and taxes to meet the stupendous burden this war has placed upon the country, and every reservoir of wealth must be drawn upon to carry this burden. The banks are called upon to absorb huge amounts of Government obligations, and if their re-

sources are not in the most liquid form this cannot be accomplished.

The Federal Reserve Act has been a saving clause in the great crisis we are going through, but it is incumbent on the banker and the merchant to make that act still more effective to the full extent of their cooperation. One way in which this can be done is by the use of trade acceptances. The great expansion of credit made necessary by essential war enterprises and the increased production of commodities at high prices bring, if possible, greater necessity for the certainty that such credit be on the strongest and most efficient foundation, and that as credit expands still further its quality be still further strengthened. This question, therefore, requires the most serious thought and consideration on the part of bankers, and in fact all prudent and patriotic business men.

Trade Acceptance Expands Business

In considering the trade acceptance, however, we must not go on the assumption that it is the only proper instrument of credit and should entirely take the place of commercial paper or that it should eliminate the system of discount for cash. Such an assumption would do the cause more injury than good as being an argument that could advantageously be used by its opponents. The trade acceptance does not conflict with either of these two methods, but on the other hand runs side by side with them. By this it is not meant, however, that the acceptance should not take the place of the promissory note in very many instances. Up to a short time ago our financial and commercial system rested upon commercial paper, but now that our banking system has been reformed, constituting consolidated control, concentrated reserves, and the beginning of a discount market, the trade acceptance is becoming more and more substituted for single-name paper and also, which is more important, for the open account.

The fundamental principle of the trade acceptance is to provide a form of negotiable paper, and the qualifications necessary to make it so are therefore very important. By negotiable paper in this instance is meant eligibility for rediscount with the Federal Reserve Bank. First, it must be indorsed by a member bank and be accompanied by a waiver of demand notice and protest; second, it must have a maturity at the time of rediscount of not more than 90 days, and, third, as I stated before, it must be accepted by the purchaser of goods sold to him by the drawer, and it must bear on its face or be accompanied by evidence satisfactory to the Federal Reserve Bank that it was drawn by the seller on the purchaser.

Advantages to the Banker

In considering the advantages of the trade acceptance four interests are involved: the banker, the seller, the buyer and the country as a whole. The banker has the advantage of negotiating a real commercial instrument representing sales of merchandise actually made, payment for which is agreed to be made at a definite future time. It is self-liquidating, being automatically payable by the bank to whom it is presented.

One of the essential attributes of a commercial bank's assets is liquidity, and this is attained to a higher degree by this class of paper than by commercial paper. The latter is presumably loans to the promissor until he receives payment for goods sold. The indebtedness of his customers is most probably carried on open accounts, which have no definite time of payment, or only theoretically so. It probably covers many such accounts, some of which may be paid before the note comes due, but some of which will not, necessitating a renewal of the note. It may be based on goods not yet sold, which may seriously deteriorate and never be sold. The trade acceptance cannot be renewed, as it can represent only current transactions.

Wider Market for Trade Acceptances

There is nothing on the face of the promissory note to indicate the purpose of its creation, and the banker, therefore, acts more or less in the dark when purchasing it. It depends too largely on the personal element of security.

Only the paper of the larger firms is negotiable in the open market, the banker having to carry in his portfolio a large amount of the notes of smaller firms. The trade acceptance, on the other hand, will find a wide market, one reason being that it bears two or more names, and the lending risk is, therefore, divided and reduced to a minimum.

One other way in which the trade acceptance is of great advantage to the banker is that the bank necessarily becomes the intermediary between the buyer and the seller, and is thereby enabled to know how promptly the buyer pays, from whom he buys and to what extent. The banker can also know the seller's customers, and in fact obtain credit information which would otherwise possibly not come to his attention.

Markets for Acceptances

In Canada and England, more especially the former, the trade acceptance is bought very freely by the banks. There a customer may have an overdraft credit representing a line that he may count on using if necessary, and that we may regard in the same light as a line on his own paper. In addition to this, if he be in good financial standing, his bank will be ready to buy a large amount of trade acceptances.

The experience of Canadian banks has been that losses on this class of paper are few, and when they have occurred they have been the result of improper care in scrutinizing the customer's credit standing.

Some bankers have in all probability hesitated to favor the acceptance because single-name paper offers a better return. The vast majority of banks, however, have recognized that it is a type of paper preferred by the Federal Reserve Bank; that it has a wider and more favorable market, and that these facts are of sufficient force to make them willing and even anxious to buy these trade acceptances, in spite of the lower interest return, for the sake of the greater liquidity.

We will next discuss the subject from the viewpoint of the seller and buyer, taking them in the order named. In the first place an acceptance held by the seller in place of an open account renders that amount of capital liquid instead of frozen. If he has been in a position of having to borrow against his accounts receivable (and that would have to be on a basis of two for one) he can now obtain practically one for one by selling acceptances to his banker at the market discount. Moreover his

liability to the bank is now simply a contingent one while heretofore it has been direct. In short it relieves him of the financial burden carried by him for his customers. By its general use his business will be placed on a more definite financial basis, and he can judge what his incoming funds will amount to by a given date and arrange his payments accordingly.

As bankers you of course realize that, in a financial statement, acceptances are a far more desirable asset than open accounts, the latter having so many objectionable features from the standpoint of appraisal and liquidity. The use of acceptances enables the seller to confine his accommodations from his bank more within the line of his actual requirements, the chief reason for this being that he can judge better what those requirements will be, and can sell sufficient acceptances to no more than fill them.

These are only the main features of the desirability to the seller of the acceptance, and those of most interest to the banker and of most use to him in advocating the use of the instrument among his customers.

The Buyer Becomes the Seller

As to the buyer our arguments must necessarily be more in the abstract, though they are none the less forceful in the face of the experience of a great number of firms who are now giving their acceptances freely. The buyer in most cases eventually becomes the seller of the goods he buys; therefore the advantages enumerated as belonging to the seller also accrue to him, especially if he is a wholesaler.

By giving his acceptance he realizes that it is incumbent on him to pay his obligation promptly, and this naturally develops in him the habit of careful buying and also a justifiable cause for requiring prompt settlement from his customers. His financial rating with his banker is improved because, by giving his acceptance, he puts himself on record as willing to pay for his purchases on a definite date, therefore placing his affairs on a sound credit basis. He is relieved of the necessity of borrowing from his bank to pay for goods that may not be sold for perhaps 90 days, whereas his acceptances can be met at maturity by the proceeds of sales of merchandise for which they are given.

General Business Advantages

We now come to the fourth interested element in the use of the trade acceptance—general business. Naturally the first desirable feature which presents itself is the stabilizing of credit.

I think you will have no difficulty in seeing that this will be an inevitable result of the general use of this form of settlement. Being, as stated before, applicable to current transactions only, the trade acceptance represents existing values and therefore precludes inflation with all its attendant evils. On the other hand it creates an elasticity of capital for further enterprise, which is entirely distinct from inflation. The trade acceptance being a preferred class of discountable paper eventually finds its way to the Federal Reserve Bank, which is the reservoir of the country's reserves, creating a legitimate and beneficial use therefor.

In the earlier part of my address I pointed out to you that the acceptance is of material use in the absorption of Government financing and intimated that by means of the Federal Reserve Bank trade acceptances can be rediscounted to provide the funds for this very necessary enterprise. Had acceptances not been very freely used in England, for instance, it is hard to imagine how that country would have been in such strong financial position as it was, thereby being enabled to carry through the huge expenditures occasioned by the war, both for herself and her allies. For this reason, if for no other, we should all be prepared to assist in the propaganda for the trade acceptance at this time. It is one of the many ways in which we can serve our country when it needs it, and though it may not be a spectacular service perhaps it is none the less useful.

The Bank Acceptance

The bank acceptance is a different class of paper from the trade acceptance in that it is drawn by either buyer or seller on a bank and accepted by that bank. An eligible bank acceptance may be created in two ways. It may be drawn by the seller for account of the buyer by means of a commercial credit or it may be drawn by the buyer to finance his purchase under a prearrangement with his bank.

To give an illustration of each method: A buyer in New York purchasing goods in Bridgeport wishes to settle by way of a commercial credit opened through his bank, which, of course, is the most desirable form of credit a seller could wish.

The bank agrees with the buyer to guarantee to the seller that it will accept the drafts drawn on it by the latter, accompanied by bills of lading or warehouse receipts covering the goods to be bought. Having drawn the draft and received it back accepted the seller has the obligation of the buyer's bank in payment for his goods, which, of course, is negotiable paper of the finest kind and which commands a very ready market. In the other case the buyer arranges with his bank to accept *his* drafts on them covering his purchases and attached to which are the bills of lading or warehouse receipts.

In each instance the bank holds the documents covering the goods as security for the extension of its credit to its customer, at the same time taking an agreement from him to provide funds to meet the acceptance at or before maturity, such agreement embodying a hypothecation of the security.

The consideration customary for a bank to receive for such accommodation averages ½ per cent. a month.

Discounting Acceptances

It is of course possible for a bank to discount its own acceptances, but this is not altogether to be desired if we are to have a broad discount market in that it tends to restrict the circulation of this prime class of paper. The Federal Reserve Board has requested accepting banks therefor to purchase acceptances of other banks in preference to their own, letting their customer sell *their* acceptance to a broker or another bank. This will have the effect of getting bank acceptances on the open market and creating a supply and demand to broaden that market.

One of the greatest obstacles hitherto to the development of the bank acceptance has been the mistaken idea that it is a sign of financial weakness for a bank to show in its statement a liability on acceptances or in fact any other liability but that for deposits. On the con-

trary it is an evidence that the bank is taking advantage of the facilities offered and advocated by the Federal Reserve Bank to increase and modernize business in line with the policy of the banks in European countries, which has been so successful.

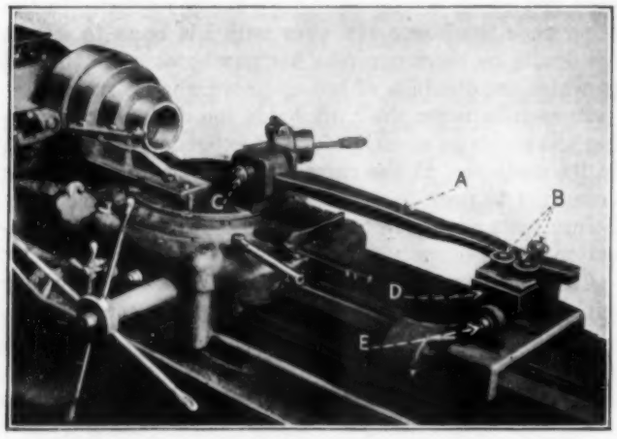
At the present time we hold supremacy in the world's money market, but we must conserve and build up for the period after the war when the countries which formerly held that supremacy again come into the field. They are making huge preparations against that time, and if we are to retain the position we now hold we must use every available resource to do so. It is the firm opinion of our leading bankers and business men that both the trade acceptance and the bank acceptance are part of those resources.

It seems therefore our duty to use our influence and our best efforts toward the increased use of these instruments of credit to build up and stabilize our financial system.

Turret-Lathe Pulley-Crowning Attachment

BY E. A. THANTON

A remarkably simple and efficient pulley-crowning attachment for a flat turret lathe is shown in the illustration. In this case a three-step cone pulley is being crowned on all three steps at once. Before using the device the turret-locking pin is removed in order that it may be free to be governed by the bar *A* which has a formed section at its outer end. This formed section is guided between the rollers *B* so that as the turret feeds along the cutting tools will machine the surface of the pulley to conform to the outline of the



PULLEY-CROWNING ATTACHMENT FOR A LATHE

master form. When not in actual use the pin *C* is withdrawn and the bar *A* is tilted up, swinging the block *D* backward on its pivot at *E*. This allows the bar *A* to clear the turret so that other tools may be used. It might be thought that the bar *A* would slip up out of contact with the rollers *B*, but close inspection will show that these rollers are flanged on the upper end so that the bar can only be pulled out lengthwise.

This device is in use in the shop of the Valley City Machine Works, Grand Rapids, Mich., and is a great help to its production.

What Are You Worth?

BY A. SCHLEIMER

You say you want your salary raised; you're not getting a square deal—you're worth more money. Are you? If you were the boss and the boss were you, would you give him more than you are getting? Are you doing everything you can? Are you taking the interest in your work you should? Do you have to be watched—your work constantly checked up? Are you making numerous mistakes—the identical ones over and over again?

If the boss came to you today and said: "Bill, I want to double your salary, but I don't think you can earn it, can you? If you can show me for the next month that you are worth it, I am going to raise your salary. It's up to you," what would you do? What is there you would do that you are not doing now? What is there you are doing now that you would do differently in a case like this?

How many friends have you in the office? How many that would be glad to see you reduced or fired? Can these men be made to feel differently toward you? Can you win them over without the loss of your self-respect? In other words, is it your fault or theirs? (Of course, this is not for publication, so you might just as well be honest about it.)

If one man were to be put in charge of the office and it were to be decided by a vote of the employees, what chance would you stand?

There are cases where a man is not getting all that is coming to him—where he's not getting what he deserves; but these are very rare in the first place, and in the second, 99 per cent. of the injustice done to a man is done by himself. If you are on to your job, if your mind is clear and your employer does not appreciate it, don't lie down and be a quitter. Keep at it, and some day you will receive a call to make good in a better opening. It may or may not be with the concern you are with, but it's got to come if you're square with yourself, and you can't be square with yourself if you are not square with the house.

Many a man hypnotizes himself into the belief that he's a better man than he is; that there's a lot more coming to him than he's getting. And it sure is some poison when it gets working. If you will quit thinking of yourself and give more thought to your actual work you will find things coming easier and better, and unwittingly you will put that indefinable something into your work that will make it stand out and attract attention.

The boss is not interested in you personally. The only thing he cares for is the results you are producing. You are an investment. Whether or not he will give you any consideration depends entirely upon yourself. If you deliver the goods he's going to take care of you—going to see that he does not lose you. There's nothing personal in this—he's got to do this for his own sake. He has troubles of his own just as you have yours. He may not show them, but he has them just the same, and the better you do your little job the less he has to worry about—the bigger value you are to him—to the organization.

There is only one man in the world who can set the standard of your value, and that man is yourself.

Women in the Machine Shop

By S. A. HAND, Associate Editor *American Machinist*

The handicap put upon machine-tool builders because of the high wages paid by munition manufacturers, which drew away thousands of their skilled workmen, could only be overcome by the machine-tool builders meeting these high wages with higher ones, thus creating a continuous cycle of wage competition, or by introducing women into their factories as operatives. The latter course has been followed by many, the subjoined article relates the successful experience of one large firm of machine-tool builders.

LAST March when the Government demanded a large increase in production from the machine-tool builders of this country many shops were handicapped because a number of their men had been attracted to munition plants by the high wages paid in that branch of work. The toolbuilders could not get their men back without paying them as much as they were then getting; this they were not prepared to do and it was impossible to get other skilled men to take their places. When the situation was put up to the Government officials they advised the employment of women.

The Modern Tool Co., Erie, Penn., was one of the machine-tool builders that tried out this scheme, and at first it met with considerable difficulty. About 25 women were hired and put in the shop among the men, the idea being that the men would show them how to do the work. At first the women were nervous and more or less frightened by the noise of the machinery and some of them quit before the day was over. Those who stuck were of course green at their jobs and were continually compelled to ask the men how to do certain things. The men not being used to women in the shop did not know how to take the innovation and no doubt some of them thought their jobs were in peril. Either on this account or from a spirit of sheer obstinacy they gave much wrong information to the women, which resulted in many pieces of work being spoiled. It was soon apparent that in order to make a success of the scheme haphazard instruction would have to give way to organized method, so a school of instruction was started. A room was equipped with a lathe, a milling machine and a drilling machine, together with a complete outfit for the inspection of small parts, and an instructor put in charge.

The first instructor chosen was one of the shop foremen—a man who had had excellent success in directing men and who knew to a nicety when work was properly done. However, he was not a success as an instructor. He knew so well how the work should be done and was so accustomed to handling skilled help that he did not understand why anyone could not do any job he gave him after a few brief instructions from him, and when the women came to him with questions from time to time as the work proceeded he lost patience with them.

Obviously he was not the man for the job. It was then decided to try out one of the toolmakers as instructor. This man showed marked ability in imparting knowledge to others; he got along well with the women, kept them from getting discouraged, imbued them with

FIG. 1. MILLING MACHINE PARTS

FIG. 2. CUTTING KEYWAYS

FIG. 3. MILLING DIE PARTS

enthusiasm for their work and made a success of things generally.

After a certain amount of training the women were transferred to the shop. They proved more deft with their hands than the men and remembered how to do the work taught them in the school, and insisted on doing it that way despite some interference on the part of the men.

Of the original 25 women employed only four are now in the company's service and they are all either forewomen or gang bosses under the regular foreman. At present 113 women are employed, most of them on general machine work, though a few are tool-crib attendants and shop clerks. All the routeing of work through the shop is done by women.

In most instances a number of women work together in the same room, but there are cases where there is only one woman in a department with a lot of men. In one a woman runs a radial drilling machine and in another a woman runs a screw machine. Several are inspectors of small parts, and their inspection is much more rigid than that of men in like positions, as they only know what the gages tell.

As to pay, women are started in the school at a uniform rate of 20c. an hour, and when transferred to the shop they are paid 25c. an hour. As they progress in efficiency their pay is raised to 27½, 30 and 32½c. an hour, the latter being the highest rate paid.

One reason that they do not receive as much as men on the same class of work is that the company has

FIG. 4 TO 9. WOMEN ENGAGED IN VARIOUS TYPES OF OCCUPATION

Fig. 4—Milling and disk grinding. Fig. 5—Hobbing and inspecting die chasers. Fig. 6—Vise, hand lathe and drilling machine. Fig. 7—Inspecting small parts. Fig. 8—The lunch room. Fig. 9—The rest room

been forced to expend quite a sum of money in designing and making such jigs, tools and fixtures as would enable women to do the work and that are not required for men. Another reason is that the whole scheme is so new that there has not been time to collect such data as would help to determine the real worth of the women compared to men, but the company is trying to devise a method of payment—either by a bonus or by the amount of work turned out—whereby the women's wage will be on a parity with that of men employed in the same class of work.

Well-equipped dining and rest rooms have been provided for the women, and they are given two rest periods of 10 min. each, one in the morning and one in the afternoon.

The class of women employed seems to be much above that of the average factory workers, and as may be seen by the illustrations they present a neat and businesslike appearance in their khaki uniforms.

While there are still many problems that remain to be threshed out the company is so enheartened over the success of women in the shop that they are planning the erection of a new and modern plant which they expect will be largely manned by women.

Injuries from Belts

By CHESLA C. SHERLOCK

Few shops ever operate for long without having trouble with a belt breaking or catching. This article outlines what an employer's responsibility is in accidents of this kind and quotes court decisions in a number of cases.

WHERE belts are used as a means of transmitting power there is always danger to employees and others. While appliances have been placed on the market for the purpose of preventing injuries to employees when something happens to a belt there are situations in which even the most carefully designed safety appliance will fail to function.

That this failure of guards and other appliances is not rare in the case of breaking belts is shown by the large number of cases which find their way into the courts. A case decided in 1913 in Louisiana may be cited. The plaintiff was the father of a minor son who was working on a planing machine. A belt 12 in. wide and 47 ft. long and composed of two thicknesses of leather broke. The boy was in line with the belt, under which was a guard that was a sort of a hanging platform 24 in. wide.

The end of this platform, however, was open and when the taut under half of the belt broke there was nothing to prevent it from shooting out and striking the boy. It was shown that the break occurred where the belt had once been repaired with rivets, and it was claimed that this act of repairing the belt with rivets constituted negligence. The evidence seemed to support this claim.

On being struck the boy lost consciousness. One of his eyes had been knocked out and the orbital cavity was so badly injured that it was impossible for him to wear an artificial eye in order to prevent disfigurement. The case was tried 13 months after the injury and the other eye was still more or less affected. The court held that a verdict for $6000 was neither excessive nor inadequate and refused to increase it.

While the employer in this case had in a measure complied with the demands for safeguarding dangerous machinery and appliances he failed to take measures to prevent a broken belt from flying out at the end and this little detail cost him heavily.

In a Missouri case a man fifty-six years old was working at a feeding machine in a linseed-oil factory. The machine was composed of two parts and was operated by means of a line shaft and a countershaft. The countershaft was known as the dead shaft and moved only when the belt was placed thereon, while the line shaft was always in motion when the engine was running. It was shown that at the time of the accident the plaintiff was standing on a platform 9 ft. above the floor assisting another employee in putting on a belt that ran the grinding machine.

This grinding machine had been out of order for a month or more and at times would choke and throw the belt off the shaft. The plaintiff was standing in a position nearer the countershaft than the line shaft and he had placed the belt on the pulley of the countershaft and was holding it on with a stick while the other employee was putting the belt on the line shaft. The belt stayed on a short time, then ran off, caught on the coupling, wound around the shaft and pulled it off from the posts which supported it. The plaintiff was knocked from the platform onto some iron housings on the floor. The alleged negligence of the defendant was his failure to guard the couplings on the shaft so that the belt would not catch, as it was shown that this could have been done without interfering with the usefulness of the machinery. The workman's injuries consisted of a broken arm, indentation of his skull, hurts to his spine and kidneys and many minor bruises. A short time after the accident he went insane and remained so for several months. It was shown that his insanity was of the form known as religious mania. A verdict of $8000 was affirmed by the reviewing authority.

In this case an accident took place which does not happen infrequently. Expert testimony at the trial stated that a simple guard about the couplings would have prevented the belt pulling the shaft from its support and causing the damage done. While it remained in doubt as to whether the plaintiff received his injuries by being thrown from the platform by the falling shaft or whether he fell the fact remains that whatever the actual occurrence the employer was held liable in the sum of $8000 because he did not have a simple guard for the coupling.

A case in Wisconsin involving a proposition under

the workmen's compensation acts arose in regard to an injury caused by a belt. The claimant was employed in a canning factory on a machine known as a "viner" and subsequently on a nailing machine. One of the nailing machines got out of repair and when the repair man came to fix it he summoned the claimant to help, by directing him to go to the basement to get some oil to fill the oil cups on the machine, which he did. He then attempted to oil a machine in motion, and while attempting to do so he stepped into a hole in the floor from which the cover had been removed, lost his balance, one leg being caught between the belt and pulley and broken.

In this connection I shall quote from the decision of the Industrial Commission as it will clear up a question of coverage under the acts as well: "The company denied compensation on the ground that the accident did not happen while the employee was engaged in performing services incidental to his employment. Crowley's employment was manifestly more than that of a nailer. He was evidently expected to do such work as might be required of him from time to time, and Lehman evidently had authority to direct his activities. At least he did so and the company makes no complaint of this. The claim is that Crowley was not directed to oil the particular machine. Crowley says he understood that he was to oil both machines. The testimony of Lehman is not very satisfactory upon this point, but we are not disposed to be overcritical of Crowley on this point. We take these youths as we find them; so must the respondents. It must define definitely and with certainty the scope of the employment of the boy or the employment will be defined by the commission as not only the particular work which the boy is given, but such as is incidental thereto, which the boy might think reasonably proper for him to do under the circumstances. This is the rule for men; it cannot be less liberal for boys. We are convinced that young Crowley did his work as he thought it his duty to do. That in his youthful enthusiasm he exceeded the expectations of the responsible head of the company who was not present and who had not limited his activities by special and definite instructions is not to be charged against the boy so as to defeat compensation."

Legislation on Belts

The subject of belts finds a prominent place in safety-appliance legislation. Where no specific mention has been made of them or where the statute is open to doubt the courts have been called upon to settle the matter.

In an Indiana case the plaintiff was killed by being caught in an unguarded belt that he was endeavoring to tighten by means of screws situated in proximity thereto. The employer was held liable. In another Indiana case it was held that a statute requiring belts to be guarded applied to the case of an employee who was injured by a breaking belt as well as by one who was injured by coming into contact therewith.

In Missouri the court reached the conclusion that the breaking of a belt was not included in the Missouri act requiring belts to be safeguarded, but in another case in the same state, where the employee was caught by a "bucking belt" and dragged over the shafting, the court held that the employer was liable. In still another Missouri case the court held that the Missouri act requiring the safeguarding of "belting, shafting, machines, machinery, gearing and drums . . . when so placed as to be dangerous to persons employed therein or thereabout while engaged in their ordinary duties" does not apply to a case where an employee tripped over a stationary belt while on his way to a time clock to register.

In an Oregon case it was shown that the statute required the employer to install belt shifters. The employee was injured by attempting to shift the belts by hand and the employer defended on the ground that he had not installed the belt shifter because there was not room and that the employee was guilty of negligence in attempting to shift the belt by hand. The court held that this plea could not be heard, as it was the duty of the employer to install belt shifters whether there was room or not, such duty being imposed upon him by statute.

A Pennsylvania Case

In a Pennsylvania case it was shown that the plaintiff in the suit had charge of certain power shears, which were driven by a belt that ran to a driving shaft on the wall and that was moved from the tight to the loose pulley by a bar; there was no belt shifter or other mechanical contrivance for shifting the belt. When iron bars were sheared the pieces were taken from the shear to the basement by means of a chute into which they dropped as they were sheared off. This chute was bolted to the anvil of the shear, and for 30 years it had been the practice not to stop the shears while attaching the chute. While attempting to place the chute in position the plaintiff's foot slipped, and he involuntarily threw out his left hand with the result that it was injured by the shear blade. The employer was held liable under the Pennsylvania act on the ground that the injury was due to the failure to provide a belt shifter so that the machine could be stopped while the chute was being attached.

The matter of repairing a belt in the proper way has also called for considerable comment from the courts. One of the best expressions on the subject is found in the decision handed down by the Louisiana court in a certain case:

"This evidence shows that the margin of safety in these belts is large enough to allow for the insertion of a few rivets without any very great risk. But it shows also that this is not the safer way of repair, but mere emergency work, merely checking the incipient disintegration, not restoring the original strength or durability of the belt, and on the contrary reducing same to the extent of every hole that is made for the reception of a rivet. While, therefore, recourse to this time-saving expedient may not constitute negligence per se it would certainly seem to impose upon the employer the burden of showing very clearly, in the event of a break, that the work had been judiciously done in strict accordance with what was known from experience to be reasonably safe."

While the court does not go on record as being in favor of any one method of mending belts it throws out a strong hint that belts which have been repaired by riveting will not be held to have shown an evidence

on the part of the employer to discharge his full duty to his employees. What might suffice in an emergency with small risk or danger to employees will not be taken to mean that employers can continue to use such methods until something happens and then plead emergency in bar of liability. While an employer undoubtedly has a right to use emergency methods when they are reasonably necessary he must avail himself of the first opportunity to do the work again according to the safest and best method at his disposal. If stitching a belt or sewing it is the only durable and safe way in which to repair it nothing short of stitching or sewing it will be accepted by the courts.

In a Missouri case the plaintiff, an experienced machinist, attempted to shift a belt with his hand. It was claimed that the employer had been guilty of negligence in failing to provide a belt shifter, but the court said:

"If it is to be said that the defendant would ordinarily be guilty of negligence in not having a lever shifter we would be bound to say that in this case it was not the proximate cause of the injury to the plaintiff. It was his own act, based upon full knowledge of the situation and prompted by his own experience and past mode of doing that kind of work. But under the circumstances developed there was no negligence on defendant's part. He had a right to have the work done in his own way, especially as that was shown by plaintiff's own testimony to be the way he had customarily done it."

Common Law

Under common law it is safe to assume that any act that is due to a workman's own negligence or gross carelessness is not chargeable to the employer. This thought was further carried out in a case where a workman was oiling the shafting in a machine shop. He claimed that the rung of the ladder upon which he was standing had broken and caused him to fall into the belting, causing the injuries complained of. The ladder was produced in court and it was shown that there were no broken rungs, the inference being that the employee had slipped and fallen into the belting and had sought to charge the employer by claiming that the ladder furnished by the employer was defective.

Apart from questions arising out of failure to guard belts properly, the greatest danger from them unquestionably arises from the possibility of their breaking under stress and strain.

The duty of the employer to adequately guard his machinery and the penalty imposed for failure to do so have already been discussed in these columns. The mere act of complying with the statute in respect to guarding belting is not an excuse for failure to adequately repair belts and keep them in repair. The mere fact that there are all the guards on a shafting that are required by law will not operate to excuse employers when they negligently use old and defective belts that are liable to crack or break.

A broken belt cannot be relied upon in view of the safety appliances installed for protecting workmen against it when it is working in its normal condition. A breaking belt may fly in any direction, and reach any number of feet. It may not work twice the same way; it might not injure anyone and it might seriously injure half a dozen workmen. This is a matter which cannot be too strongly urged. Employers must provide safe places in which to work and reasonably safe tools and appliances. This includes belts and shafting and all the appliances necessary for their safe operation.

While the phrases have been changed a little under the workmen's compensation acts the spirit of the old common law to prevent injuries and to do all that can be done to safeguard employees before they are injured still remains.

Hot Punching of Holes in Armor Plate

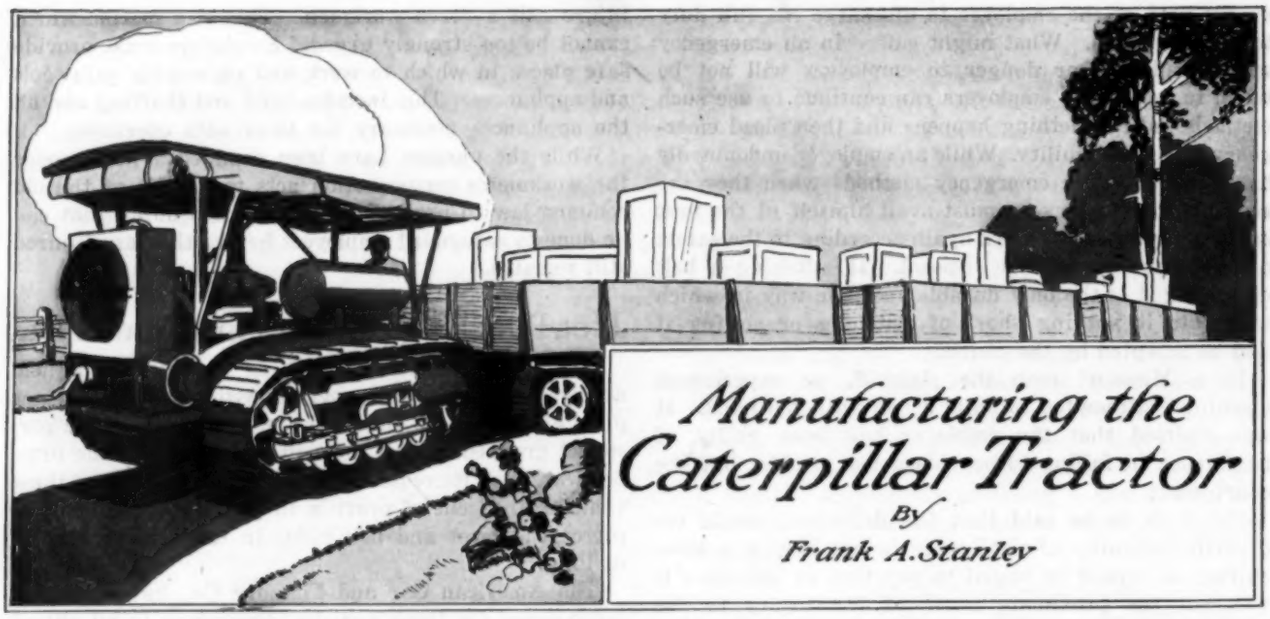
Certain of the vehicles, such as the caissons of field artillery material, are provided with shields of armor plate about 0.15 in. thick for the protection of the personnel grouped behind them in action. Until the present war, with its requirement for vast numbers of these vehicles, the general practice in producing them was to pierce the rivet and bolt holes in the armor plate by drilling.

The American Car and Foundry Co., having a very large order for these vehicles, amounting to an output of about 300 vehicles a day, felt the imperative need of finding a way to pierce these holes more rapidly than by drilling. It therefore evolved a new method at its Detroit plant whereby the plate is locally heated in a spot about ½ in. in diameter at the desired location of the hole and immediately punched hot. A multiple punch is used by which all of the holes in a plate may be punched at one operation, individual burners being provided and locally heating the plate at the location of each hole.

A thorough investigation by the Ordnance Department, together with tests on the structure of the metal and the ballistic properties of the punched plate as compared with the original plate, revealed that the new perforations made by punching were superior to those obtained by drilling, and that the extremely localized application of heat did not injuriously affect the structure or ballistic properties of the plate; in fact the spot that had been heated appeared to be harder and to have more resistance to penetration after cooling than the part of the plate which had been unheated.

The great advantage of the punching method is in the saving of time. In drilling armor plate with carbon-steel drills it has usually required about one minute to drill one hole in favorable samples of armor plate, and in very hard samples it has taken seven or eight minutes to drill one hole, each hole being drilled separately. But in punching armor plate hot the whole plate is punched at one time and the entire operation of placing the plate on the machine, running it into position over the burners, thence back to the die, punching and removing it from the machine, takes about thirty seconds. When it is considered that the armor plate used on a caisson for 75-mm. gun material consisting of three pieces—the apron, chest-back and the door—contains 222 holes the time saved by the hot-punching process is enormous.

The results of the investigations and tests of the hot-punching process and its results were so gratifying that the Ordnance Department approved of and directed the use of the method in place of the drilling process previously used.



Manufacturing the Caterpillar Tractor

By Frank A. Stanley

V. Small Parts

The heads for motor cylinders are machined by the aid of indexing jigs for obtaining correct settings, and similar practice is followed in the case of manifolds and other parts. Clutch disks are drilled four at a time, and other small work is held, several pieces at once, for operations under the drilling-machine spindle. Some large bevel gears are planed in remarkably short time.

ONE of the interesting lines to follow through the various machine processes is the manufacture of the cylinder heads for the motors used on the "Caterpillar" tractor. Four heads are required for each motor, consequently they are put through the shops in large quantities, as may be inferred from Fig. 38. In Fig. 39 is shown along with a head casting the two poppet valves, one in place and the other at the side with its guide and spring near by. Fig. 40 gives a clear idea of the interior form of the head and the position of the valve seats inside.

This head casting is faced on the bottom before it is sent to the drilling department. The stud holes are put through in a simple jig under a multiple-spindle drill. The valve seats are put through a grinding process later, where the valves are ground in and properly seated by means of a novel automatic machine which will be described at some other time.

In machining the seats and shoulders for the manifold connections the jig used is in the form of an angle-plate base carrying at the top a bracket in which is located the bushing for the hollow milling and facing tool for finishing the surfaces. The work-holding portion of the jig is a sliding plate, which is provided with a seat in its outer face to receive the shoulder on the underside of the cylinder head and so locate it properly, while suitable clamping means are included to secure the head in place for the operation.

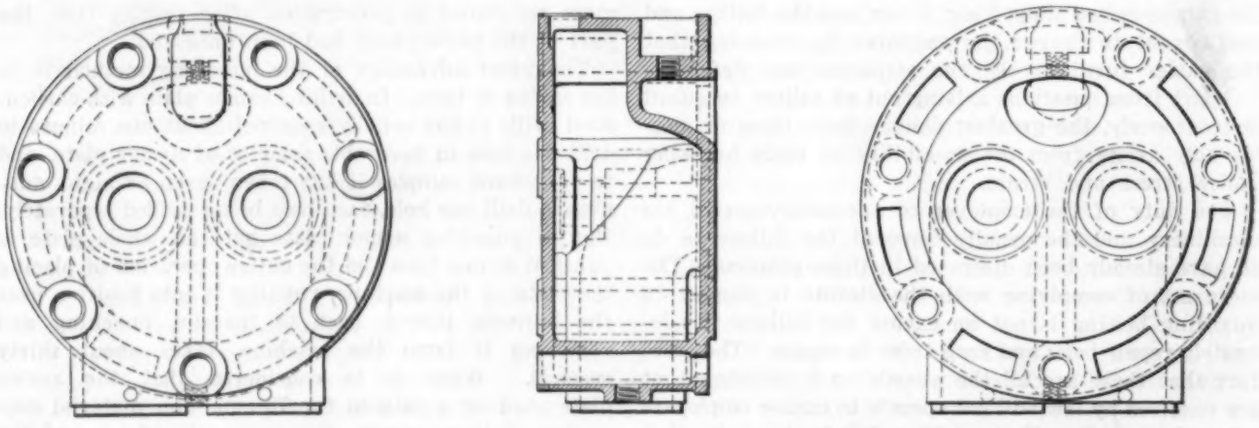
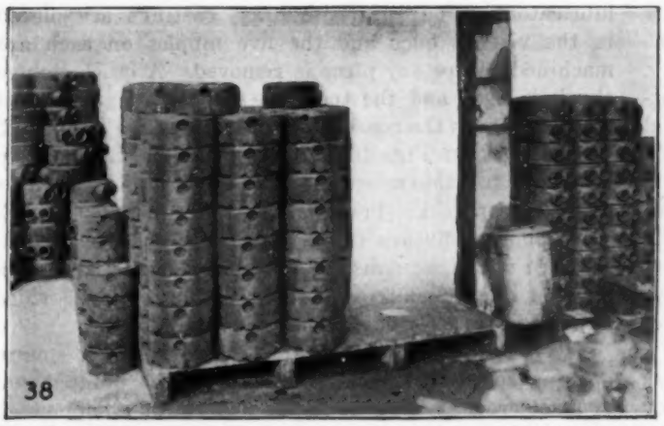
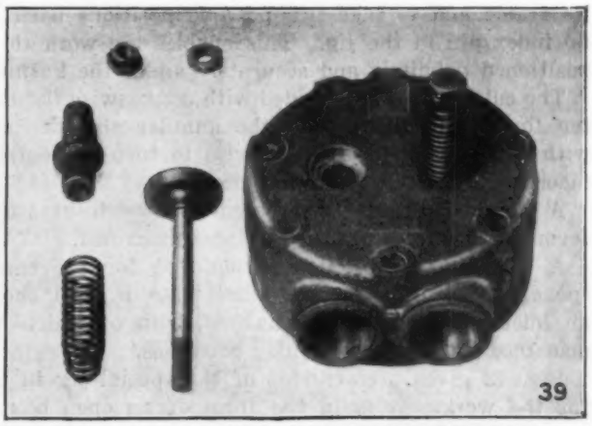
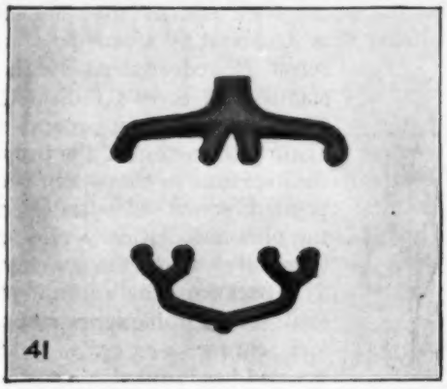


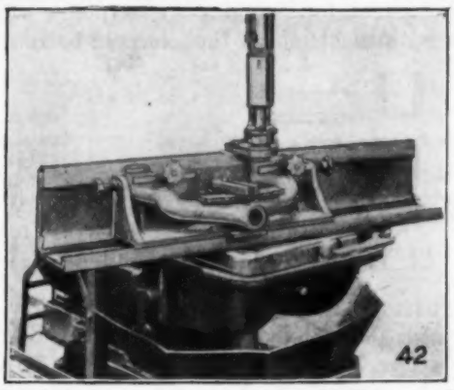
FIG. 40. DRAWING OF THE HEAD

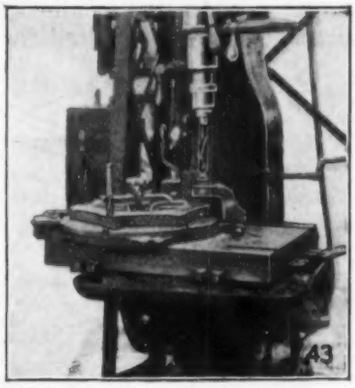
The carrying plate is adapted to slide laterally along

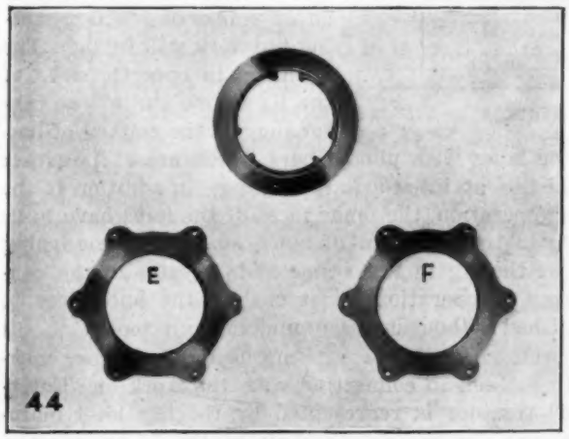


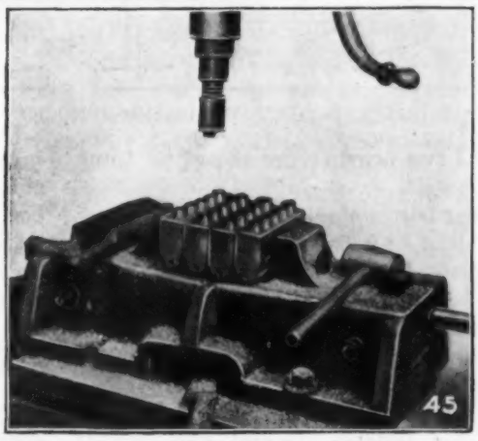


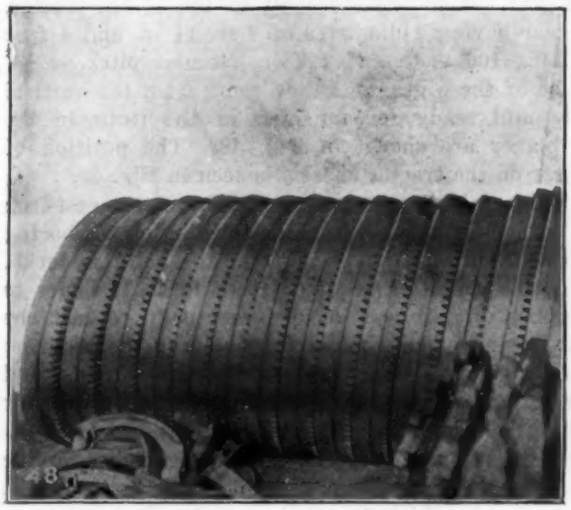


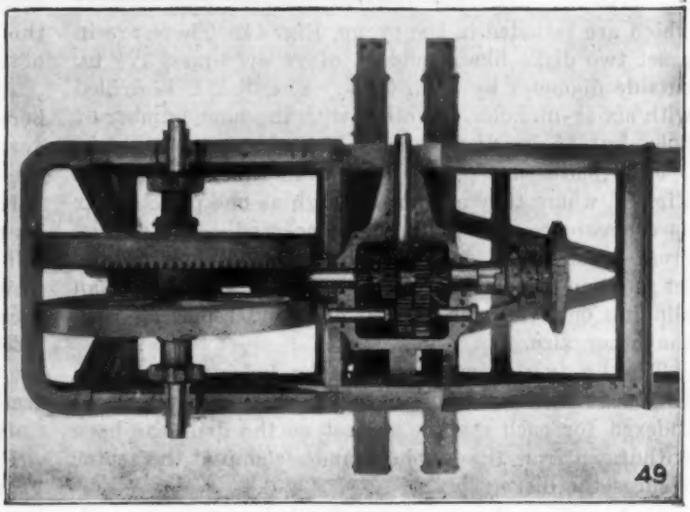












FIGS. 38, 39, 41, 42, 43, 44, 45, 46, 48 AND 49. VARIOUS TRACTOR PARTS AND SOME OPERATIONS ON THEM

Fig. 38—Cylinder heads. Fig. 39—The cylinder head and its valves. Fig. 41—Manifolds. Fig. 42—Manifold in the jig. Fig. 43—Drilling clutch disks. Fig. 44—Some members of the clutch. Fig. 45—Machining lubricators. Fig. 46—Cast-steel fork. Fig. 48—Large bevel gears. Fig. 49—Gears in place on the chassis

its frame and to take two positive positions fixed by an index pin in the jig. This enables the work to be positioned definitely and accurately under the bushing.

The cutting tool is provided with a crosswise flat cutter for facing the end of the annular shoulder and with two cutters inserted endwise to turn the outside machined by precisely similar processes.

A stop collar carried by the cutter head insures uniform heights in all of the surfaces machined.

A similar type of jig is employed for the corresponding operations on the manifolds. Fig. 41 shows an inlet and an exhaust manifold, both of which are machined by precisely similar processes.

Fig. 42 gives a clear idea of the special jig in use for the work. It is in the form of an open box or frame in which the manifold is secured by swinging straps, and these combined with a third clamp at the point of union of the two arms secure the whole thing in the jig.

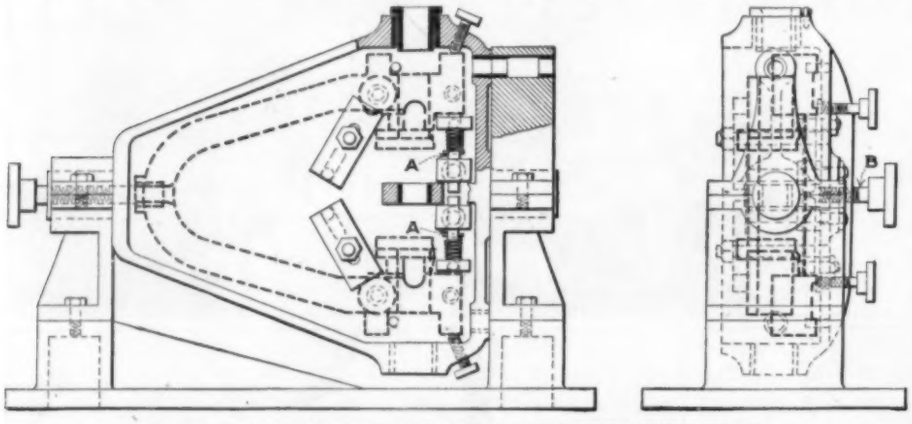


FIG. 47. BORING FIXTURE FOR BLANK-SPROCKET FORK

The holding member is mounted upon a guide surface planed in the base of a long fixture carrying a guide bushing in a plate fastened to the top about midway of the base length. The work-holding frame slides along the fixture and is set at predetermined indexing points to bring the manifold openings at the right positions for machining the ends.

The illustration, Fig. 43, shows the method of drilling friction disks for clutches, several members of which are included in the group, Fig. 44. There are in a set two disks like *E* and *F*, of yellow brass, 17¼ in. outside diameter by ⅛ in. thick. The disk *E* is drilled with six ¼-in. holes, the other with the same number of holes but ⅜ in. diameter.

Four plates are placed at once in the jig shown in Fig. 43, where they are put through as one piece so far as convenience of handling is concerned. The change from a lot to be drilled with the small hole to the lot requiring the larger hole means nothing further than slipping out the bushing and drill and replacing with the other size.

The jig is constructed upon the indexing principle with a notched work-holding plate which is rotated and indexed for each station as fast as the drill has been withdrawn from the last hole, and a clamp at the center secures the disks.

In Fig. 45 is shown a setup for hollow-milling, drilling and threading the connection lugs on sight-feed lubricators. Four of these brass castings are placed in the vise at once and the five nipples on each are machined before any piece is removed. A quick-change chuck is used and the tools are slipped in and out of place as fast as the consecutive operations are completed.

The work in Fig. 46 is a steel casting that has to be bored for the reception of a shaft upon which is mounted a sprocket known as a track idler.

The boring fixture is shown in Fig. 47 and is constructed with trunnions for the holder so that the work may be indexed half over to bring the opposite sides upward in turn for operation under the tool.

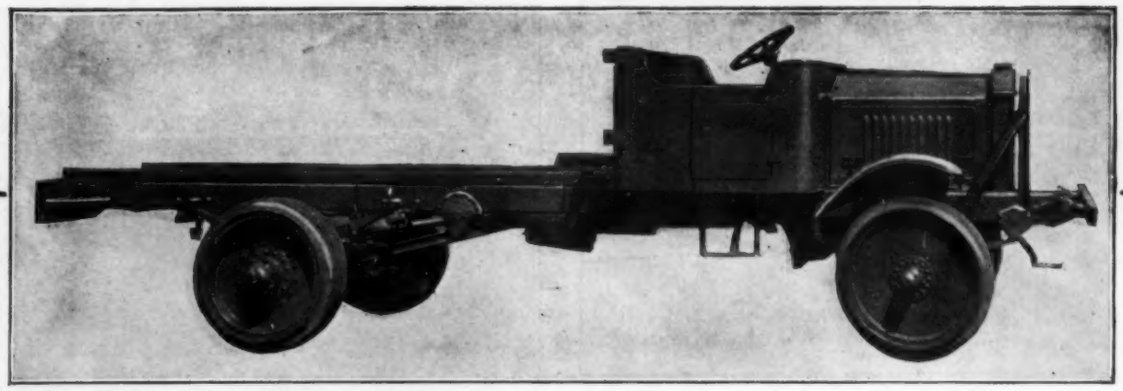
The narrow end of the steel casting has a square opening cored in it, and this receives the pointed end of a setscrew at one side of the fixture for a support at that point, while the broad open end of the fork is located by centralizing pins *A* opened by a cone-pointed screw *B* and secured by the clamps and screws indicated. The pins *A* are operated against the action of the pressure springs so that when the pointed screw is withdrawn the pins automatically release themselves from the casting. The backs of the forks rest against adjustable screw stops, and corner screws with knurled heads furnish a method of supporting and fastening the work still further. The bushings in opposite sides of the jig frame and at the center suggest the method of boring the holes with piloted bars which are still further steadied by an intermediate bushing. In addition to the boring operation, the inner faces of the hubs have to be machined to a definite distance apart so the turning over of the jig in the frame adds greatly to the convenience of operation, as it enables the hub faces to be finished without using an undercutting tool.

The largest and most striking example of gear making to be seen in connection with the work on "Caterpillar" tractors is represented by the big level main-drive gear for the countershaft of the 75-hp. tractor, this gear having a diameter of 4 ft. 1½ in. and a face of 4½ in., 106 teeth and 1.46-in. circular pitch.

A lot of these gears as they come from the vertical boring mill ready for finishing of the teeth in the gear planer are shown in Fig. 48. The position of the gear on the tractor chassis is seen in Fig. 49.

It was originally the practice to make this cast-iron gear with the rim solid, machine the ring on the boring mill and then cut the teeth from the solid material. This latter operation required from 12 to 14 hours to accomplish, and it was decided eventually to cast the teeth, leaving enough metal for finishing the teeth on the gear planer. So a brass pattern was made, and teeth cut in it, leaving $\frac{1}{16}$ in. of metal all round for finishing on the casting.

By using this pattern the teeth were planed in the gear rings in an average time of 2½ to 3 hours, the lowest time in which the work was done being 1 hour and 40 minutes.

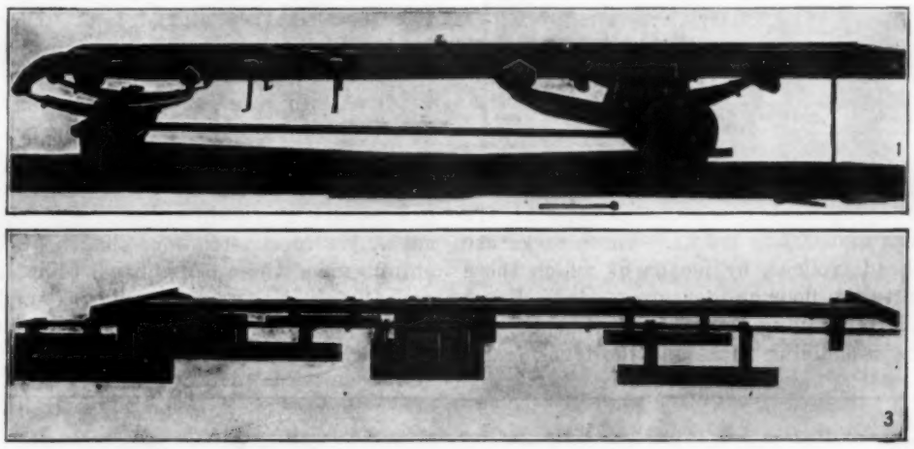


Building Trucks for the Aviation Service—I

By M. E. HOAG

In a previous article the writer described the building of the Style B Liberty truck in a Western factory. This article will deal with the building of a 3½-ton special truck for the U. S. Aviation Signal Service.

THE building of a limited number of heavy trucks does not warrant the use of special machines, tools and jigs to the same extent that they are used in the production of automobiles or standard commercial trucks in large numbers, and the ingenuity of the engineer and designer is therefore often taxed to the limit to devise ways and means of getting out the work at a reasonable cost. Some of the simple but efficient methods used by the Velie Motors Corporation, Moline, Ill., in making special trucks are described in this article. The aviation heavy truck is of 3½ tons capacity and is built up largely of standard units, such as the frame, axles, engine, transmission and steering gear, with a limited number of special parts which require machining operations. The shop where these trucks are built is a long, narrow, single-story building of brick and concrete construction, with machine shop at one end and a separate structure for storage of stock. A system of overhead trolleys and air hoists facilitates handling.



FIGS. 1 AND 3. TRUCK FRAME AND JIG FOR DRILLING IT

The assembling floor occupies the center of the building and is wide enough to accommodate two rows of trucks, the side bays being used for separate-parts assembling and for work benches, etc. The assembling of the trucks starts at the machine shop and stores end of the shop and as the work progresses the trucks are moved forward, leaving the front of the shop ready for testing and shipment.

The assembling floor is laid off in two rows of tracks which are made of I-beams laid on their sides so that they form channels in which run the wheels of the assembling racks; the truck itself does not touch the floor until it is practically completed.

At this point in its progress four inclines of 3 x 12 planking, which are bolted to the floor, come in contact with the trucks wheels and the truck under its own power moves forward and upward, thus raising itself sufficiently to allow the removal of the assembling racks without the use of jacks or cranes. A truck frame and axles mounted on one of the assembling racks is shown in Fig. 1. The construction of one of the assembling racks with a front axle in place is shown in Fig. 2. This construction is quite simple, the support *A* being cored castings, with the tops milled flat to receive the raising blocks *B*, by which they may be adapted to various heights of truck. The bottoms are turned and grooved to receive the casters *C* which swivel on ball-bearings. The wheels of the casters are not turned, but are ground to remove fins and rough places, and then chucked true and bored.

The supports are tapped with a standard pipe tap, and the iron pipes which form the frame are screwed into place.

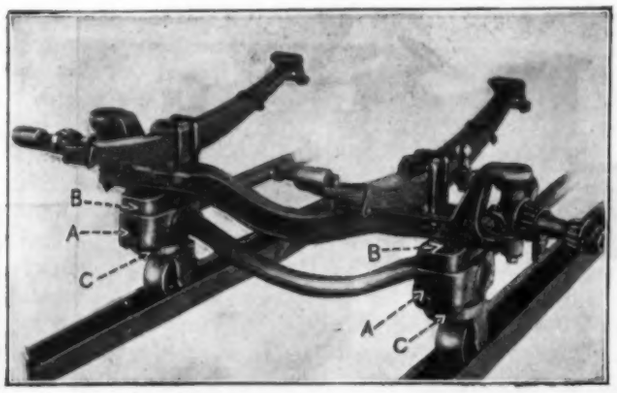


FIG. 2. FRONT AXLE MOUNTED ON ASSEMBLY RACK

The truck frames as received from the manufacturer consist of the side sills, cross-members and braces, but they are not punched or drilled for the brackets, motor hangers, etc. For drilling the bolt and rivet holes for these parts skeleton drill jigs, one of which is shown in Fig. 3, are used. The jigs are built up from cold-rolled steel, and while quite light are very substantial and accurate, all holes being bushed with hardened bushings. The drilling is all done with air drills.

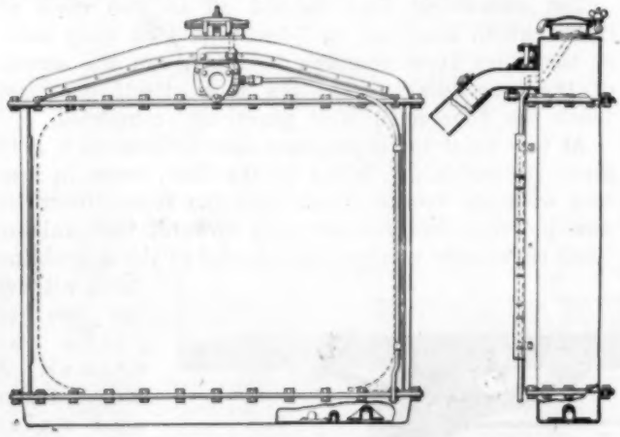


FIG. 5. DETAILS OF RADIATOR CONSTRUCTION

Separate storage racks for engines, axles, etc., are provided near the assembling tracks. These racks are served by overhead trolleys, by means of which these parts are moved to the floor as they are needed. Front and rear axles, after having the springs attached, are lowered onto the assembling racks and the truck frame

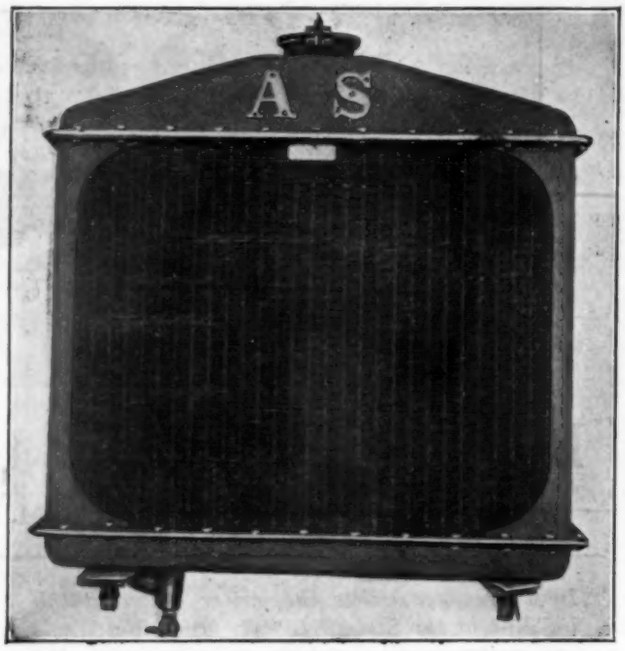
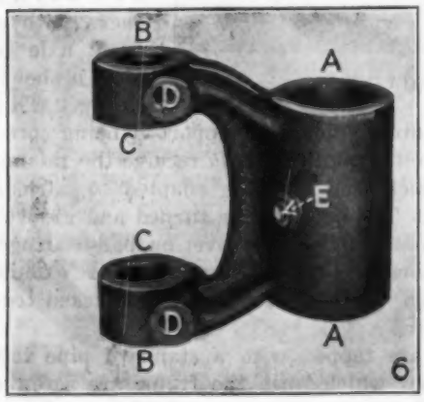
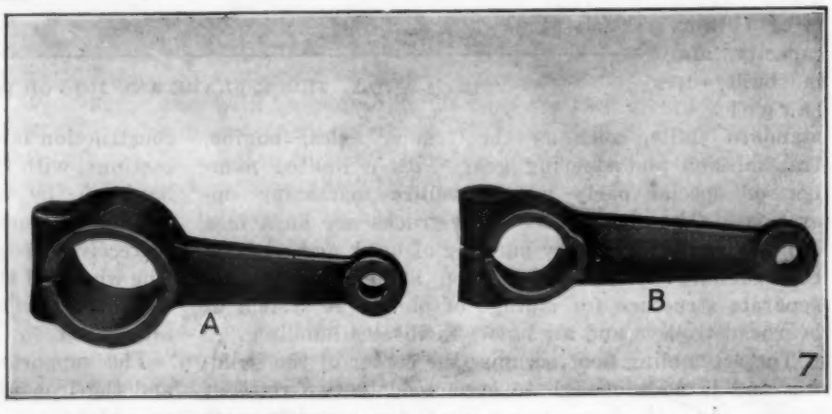


FIG. 4. RADIATOR READY FOR ASSEMBLING

is lowered into place and fastened as is necessary. The radiator shown in Fig. 4 is composed of separate units purchased outside and assembled in the shops. The radiator assembling is shown in Fig. 5, and gives a good idea of its construction. All brackets, supports, etc., are either drop-forgings or steel castings, and while none of the machining operations are difficult a brief outline of some of them will be given. The rear spring shackle shown in Fig. 6 is a drop-forging. The surfaces at *A*, *B* and *C* are first milled to size. The piece is then jigged, and under a four-spindle gang drill the opening at *A* is rough-drilled and bored, the two large holes at *B* and *C* are drilled, and the two drift-pin holes at *D* drilled and reamed and the hub spot-faced. The hole *E* for the oil cup is also drilled and tapped. The holes in the bosses are afterward reamed to line by hand.

Two levers are shown at *A* and *B*, Fig. 7, and are so simple in construction that no description of machining operations is required. The faces of the large ends being disk-ground and the small ends straddle-milled, the holes are then drilled and the keyseats cut, after which the slots are sawed in the milling machine.





FIGS. 6 AND 7. REAR SPRING SHACKLE AND LEVERS

A Quenching Machine for Hardening Small Drawing Dies

SPECIAL CORRESPONDENCE

A MACHINE for cooling or quenching small drawing dies has been developed by the S. A. Potter Tool and Machine Works, 70 East 130th St., New York. This firm builds special gages and tools of many kinds, and among its contracts is one that calls for thousands of small drawing dies ranging from $\frac{3}{16}$ in. to 1 in. inside diameter for drawing cartridge shells and bullet jackets.

In hardening these dies the usual amount of trouble was experienced, there being an appreciable percentage of losses from cracking and distortion. Seeking a means of eliminating these losses the machine, front and rear views of which are shown respectively in Figs. 1 and 2, was built as an experiment.

FIG. 1. FRONT VIEW OF QUENCHING MACHINE

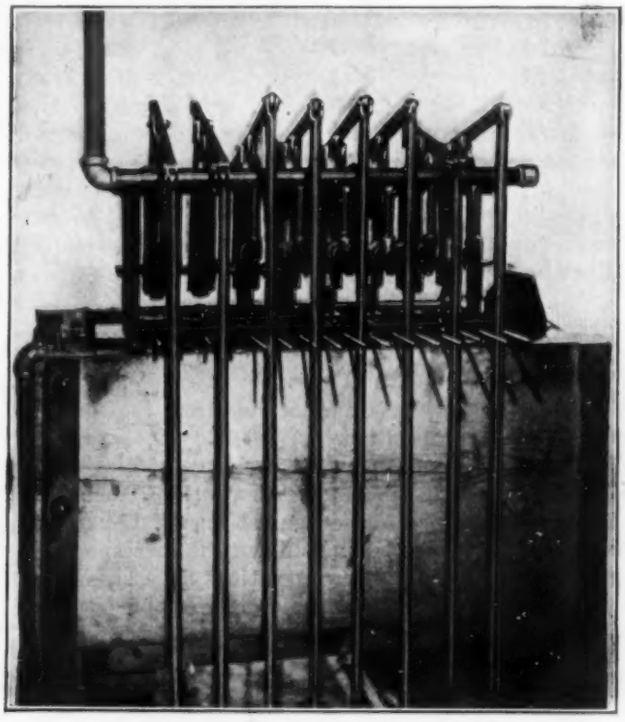


FIG. 2. REAR VIEW OF QUENCHING MACHINE

A wooden tank, or vat, about 18 x 30 in. and about 10 in. deep was built and mounted on legs to bring its top to a convenient working level. Across the top of the tank is a bridge made from a rectangular-section machine-steel bar, and upon it is located eight brackets, each carrying a vertically sliding spindle, giving the machine somewhat the appearance of a multiple-spindle, foot-operated drilling machine.

These spindles are hollow and are closed at the upper and open at the lower end, and each has a port in its side which coincides with a similar port in the inclosing bracket when the spindle is in its lowest position. Fig. 3 is a section of the bracket and spindle showing the valve action of the latter.

The brackets are all connected to a source of water supply, and thus when a spindle is down a stream of water will flow through its port and out at the lower end. Raising the spindle closes the port, shutting off the flow of water. Under each spindle is a grating upon which rests the die to be quenched, the openings of the grating being so calculated as to restrict the flow of water and insure that the die be completely filled. These grates are flush with the top surface of the bridge, and are changeable to suit different diameters of die.

The lower end of each spindle is fitted with a plug which projects partly through the die to be quenched, but leaves an annular opening for the water, the object being to throw the force of the stream strongly against the surrounding walls of the hot die and prevent the formation of a steam blanket, which would retard the cooling.

When a spindle is down its lower end contacts with the upper surface of the die, shutting off the escape of water in a lateral direction and forcing the entire flow through the hole. The result is that the inner surface of the die is cooled very quickly and the outside comparatively slow, leaving the working surface glass hard for a depth of perhaps $\frac{1}{16}$ in., while the surrounding metal demains soft enough to be marked with a file.

Under each spindle is a locating gage which consists of a V-shaped notch in the end of a spring-operated, horizontally sliding plunger. As the spindle is raised from a cooled die this plunger slides forward and punches the die off the bridge into the tank whence the accumulated dies are removed at the convenience

of the operator. The position of the gages is adjustable, so that dies of different diameters may be brought to a central position under the spindle.

Each spindle is provided with a treadle, permitting one man to handle all the quenching, but as the hardener has a helper anyway it has been found more practical to have the helper operate the machine

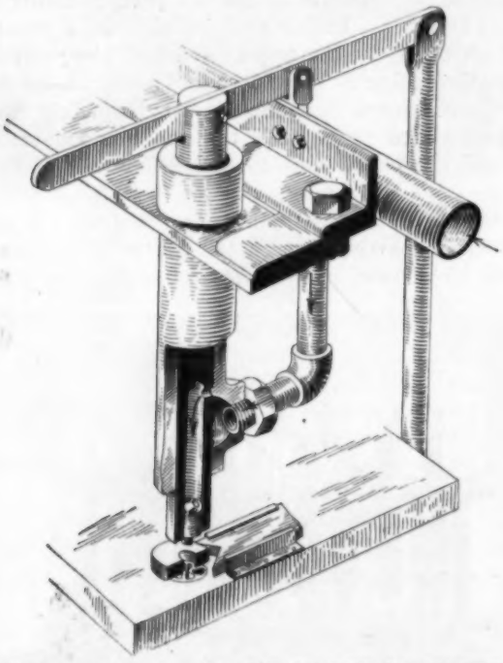


FIG. 3. SECTION OF ONE OF THE BRACKETS

while the hardener takes the hot dies from the furnace and places them in position.

The operation is as follows: A charge of dies being ready in the furnace the hardener transfers them one at a time, setting each one against one of the gages. The helper immediately brings down the corresponding spindle, and after four or five positions have been filled he raises the first spindle, which movement operates the horizontal plunger to push the die, which by this

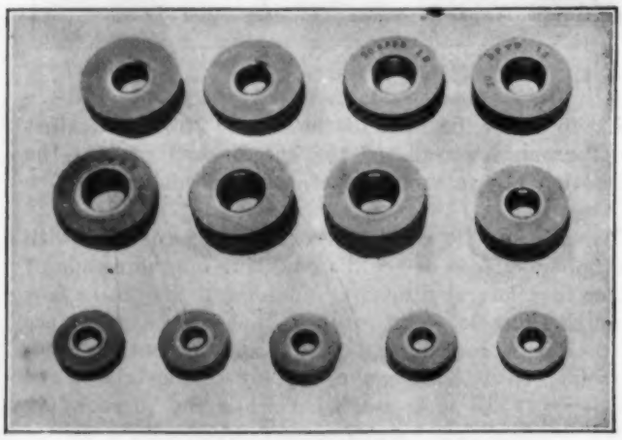


FIG. 4. SOME OF THE HARDENED DIES

time has become sufficiently cool, into the tank. Thereafter, as each successive spindle is set down on a hot die, a corresponding spindle four or five places back is raised from a cooled one, leaving two or three vacant positions ahead of the hardener at all times.

As no water is flowing except when a spindle is down, and as its escape over the top of the die is then cut off by contact between the end of the spindle and the top surface of the die, there is entire absence of splashing and sloppiness; in fact, there is practically no water in evidence at any time except that in the tank below the bridge, and this is maintained at a constant level by means of an overflow.

With this machine two men will harden from 150 to 200 dies an hour, the limiting feature being the furnace. With sufficient heating capacity the output could be doubled or tripled.

The loss from breakage has been reduced to 1 per cent., and the necessity for a drawing or tempering operation has been eliminated, because the soft metal surrounding the hardened working surface prevents it from cracking.

There is remarkable uniformity in hardness of the product, as the heat of the furnace is maintained constant by means of a pyrometer and all dies are quenched under exactly the same conditions. The line of demarkation between the hard and the soft portions is plainly discernible when the dies are removed from the tank. Fig. 4 shows a number of these dies ready for use after the hardening process has been completed.

Setting a Universal Machine to Grind Parallel Holes

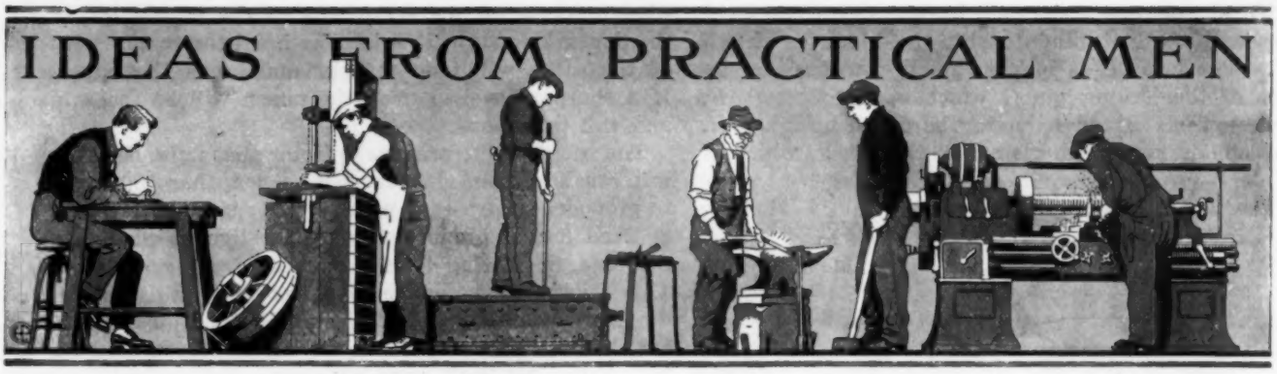
By Charles Eldridge

In setting up a universal grinding machine for an internal-grinding operation difficulty is sometmes experienced in setting the swivel headstock to bring its spindle parallel with the travel of the platen, which condition is necessary to insure straight holes. The graduations on the swivel base cannot be relied upon for extreme accuracy because a slight amount of dirt between the headstock and the platen or of play between the aligning blocks and the platen slot often causes slight errors that setting by the graduations alone will not overcome. Any mechanic realizes that the cut-and-try method applied to internal grinding is slow and its results uncertain. The following procedure, however, is rapid and always gives accurate results.

Before setting up the machine for internal work the chuck should be placed in position on the headstock spindle and a piece of round stock clamped in the jaws. This piece should project from the jaws about the same distance as the depth of the hole to be ground. The piece should run approximately true and should have a groove ground in it close to the jaws for the grinding wheel to dwell in during reversal.

Now proceed to grind this piece with the regular wheel used for cylindrical grinding until it is round and the wheel sparks evenly. The piece is calipered and the headstock reset until the test piece used measures parallel.

The machine is now set up for internal work, and as the headstock spindle is in line with the ways of the platen it is obvious that internal work now ground will be straight. A regular internal-grinding machine may be set parallel in the same manner, in which case the regular wheel used for internal grinding is employed to grind the test piece.

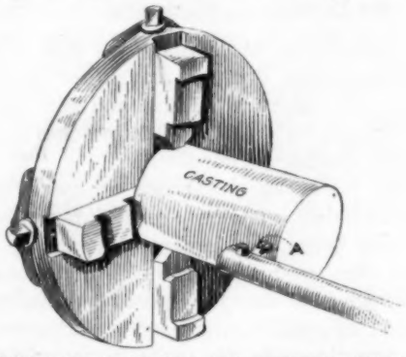


Parting Off Piston Rings to Accurate Width

By M. G. Datson
Broken Hill, N. S. W., Australia

In turning automobile piston rings and similar work I had some difficulty when parting off in getting the rings all the same width, but have now got over the difficulty as follows:

The ring casting is bolted to the faceplate and is turned and bored in the usual manner. The compound rest is then set parallel with the ways of the lathe



TOOL FOR PARTING OFF PISTON RINGS

and a small parting tool is held in the same bar as was used for boring. The parting tool is made as shown in the sketch, the curved edge *A* for facing being a few thousandths wider than the blade.

The carriage is clamped and the end of the casting is faced, the graduated dial on the compound rest being set at zero. The compound rest is then fed along far enough to part off a ring, gaging the thickness by noting how far the tool is fed along according to the graduations on the dial. The ring is then parted off, the tool being fed in until the edge *A* faces the end of the casting again.

If not quite the right width make the next one a thousandth or so wider or narrower as the case may be. They can generally be got right after parting off one or two rings.

By this method all that is then required is to give one side of the ring a rub on a sheet of emery cloth to take off the burs.

The compound rest can be used in the same way when regrooving the pistons on account of the grooves being worn. The top groove is usually worn more than the others, and can be made a few thousandths wider and allowance made for this when parting off the rings.

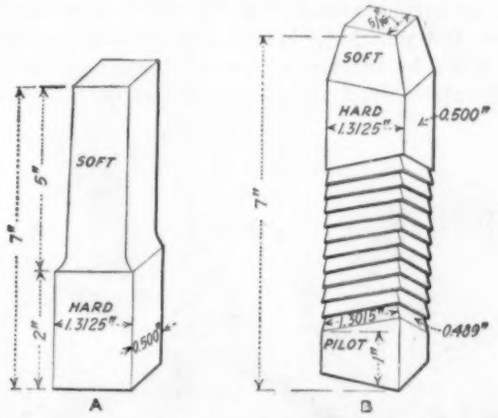
A Broach That Worked and One That Didn't

By H. P. Michels

Having a number of special boring bars to make that were to have a cutter slot 1.3125 in. by 0.500 in. in size, with limit of variation of 0.0005 in. in either direction, we decided to make these holes as closely as possible to size upon the slotting machine and finish them with the single-cut broach shown at *A* in the illustration.

This did not prove satisfactory, as the single-cutting edge of the broach tended to float one way or the other, according to which side was the sharper, and the result would be a crooked hole with ragged surfaces.

The new broach *B* was made with 10 cutting teeth, the size increasing in steps of 0.001 in. each. They



SUCCESSFUL AND UNSUCCESSFUL BROACHES

were made with a shearing angle of 8 deg., were spaced 1/4 in. part, were 3/64 in. deep, and a land of 1/64 in. was left at the edge of each tooth. A cutting compound of white lead and turpentine was used and the results were all that could be desired, leaving a smooth, true hole within the required limits.

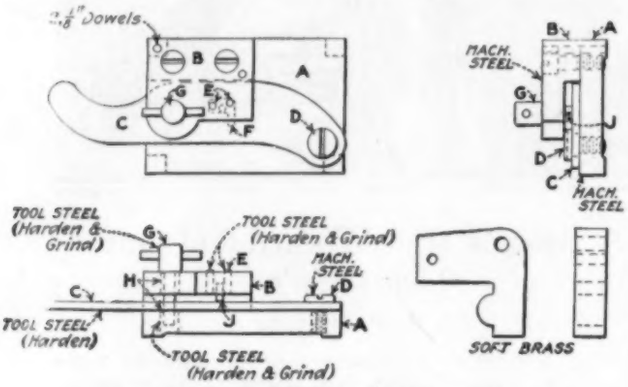
A Simple Drilling Jig

By William Philip

The drawing here shown is a jig for drilling the small piece at the right. Accuracy is required in the location of the drill holes in relation to one another.

The jig consists of a base *A* onto which is fastened a top piece, or bushing holder *B*, having a space underneath to enable the lever *C*, which swings about the

stud *D*, to pass under the drill bushings *E*. The lever *C* has a profiled opening to suit the blank as shown at *F*. The lever *C* is locked into proper position by means of the locking pin *G* which passes through *B*, *C* and *A*, parts *B* and *A* having hardened bushings *H*. The blank is kept from rising by the pin *J*, which is



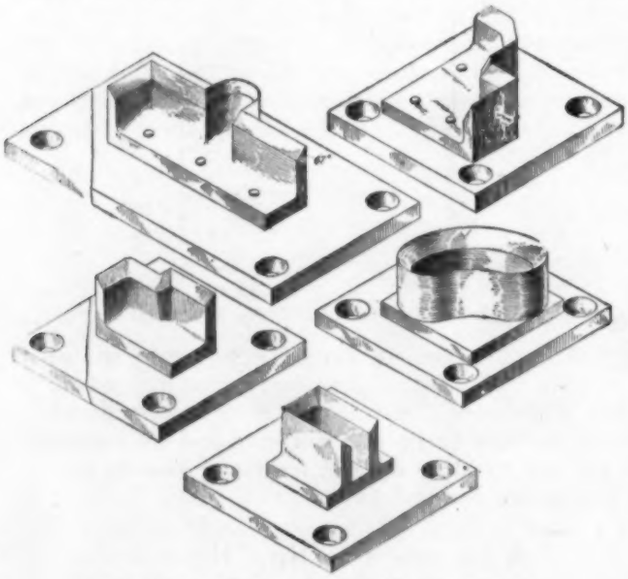
JIG FOR DRILLING SMALL BLANKS

set so that the lever *C* and the blank pass under it, allowing just sufficient clearance for the variation in the thickness of the blank, which was only a few thousandths.

Blanking and Trimming Tools for Wood

By Frank A. Tibbals

The tools shown in the cut were developed for rapid production on airplane work, for the purpose of notching corners and punching round and irregular-shaped holes and slots in three-ply veneer. Any shape that can be cut out of sheet metal can be cut out of wood



FORMS OF CHISEL PUNCHES FOR WOOD

with this style of punch. They will cut a clean, sharp edge on both sides of the sheet, leaving the material free from slivers so that sandpapering will be unnecessary.

It has been found by experiment that 67 deg. included angle for the punch gives the best results. The beveled edge must be on the scrap side of the punching. If the punch is made with a blunter bevel the compression of the scrap will tend to split and break the punch. If a sharper bevel is tried the punch will be too thin and will break out.

The speed of the press is a factor that must be taken into consideration. It must run not less than 100 r.p.m. to produce a sharp edge on the wood; if a slower speed is tried it will produce a rounded, slivered edge. The die base, or cutting block, is made of end-grain wood 1 in. thick, and the punch should not enter this wooden die block over $\frac{1}{64}$ in. The block will stand up for 2000 cuts before redressing. Babbitt has also been used for this lower die with good results.

Punches for round and irregular-shaped holes should have internal strippers with light springs to eject scrap. Care should be taken not to make the spring tension too strong, as the scrap must bow upward inside of the punch on account of the bevel, and if the springs are too strong there will be a tendency to spread and break the punch.

Punches should be made of a good grade of tool steel hardened and drawn to 600 degrees.

Tool for Burring Inside of Dummy Cartridge Shells

By Donald A. Hampson

In training recruits to manipulate the rifle and for other practice purposes dummy cartridges are used. These cartridges are identical in size and contour with the service cartridge, but they contain no charge, making an accidental discharge impossible.

There having been some narrow escapes through loaded cartridges being mistaken for the dummies that the men had been using, the general appearance being about the same, changes have been made in the dummy, which make it possible for the most careless recruit to instantly feel or see (or both) the difference and make his rifle practice safe for those in the vicinity.

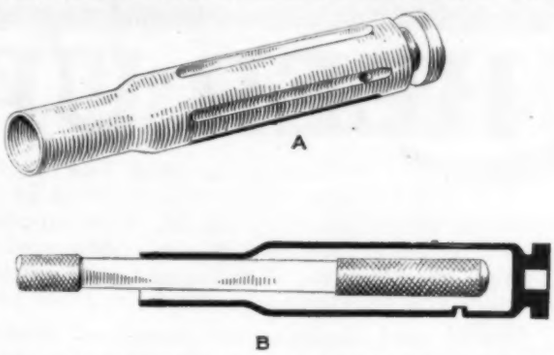
The Springfield dummy cartridge shell is shown at *A* in the cut. Six longitudinal creases, or grooves, are formed in the body and in every other groove a $\frac{1}{8}$-in. hole is punched, in addition to which the shell is silver coated, making a sharp contrast with the loaded cartridge.

The Hollifield practice rod is a device extensively used in the Army for rifle practice without ammunition. It consists of a pointed rod held within the bore of the gun to be driven out by the blow of the firing pin. In rapid-fire practice the regular service clip of five cartridges is loaded in the magazine, "fired" and ejected. Each cartridge is a dummy containing a rod to transmit the blow to the practice rod in the bore, this dummy rod sliding in bearings and having attached parts within the cartridge shell.

Ordinarily the interior of the dummy shell is empty space, but as used in the Hollifield method the space is fully occupied and the bur from punching the holes previously mentioned retarded the work of manufacture quite seriously. The fact that the inside diameter of the neck is smaller than the smallest diameter in the body of the shell made it difficult to remove the bur. The holes are merely for the purpose of showing that the interior is empty, so in the manufacture of dummies

little attention is paid to the kind of a hole punched and an abnormal bur is no cause for rejection.

The method finally adopted for the removal of the bur is shown at *B*. Round files were broken up into sections 3½ in. long, one part of which was not over $\frac{9}{32}$ in. in diameter, a size that would readily enter the neck of the shell. The teeth of the file were ground off for a distance of 2 in. in the center of each section, which reduced the diameter enough to more than offset the difference in inside diameters of the shell. These



DUMMY CARTRIDGE SHELL AND MANNER OF BURRING

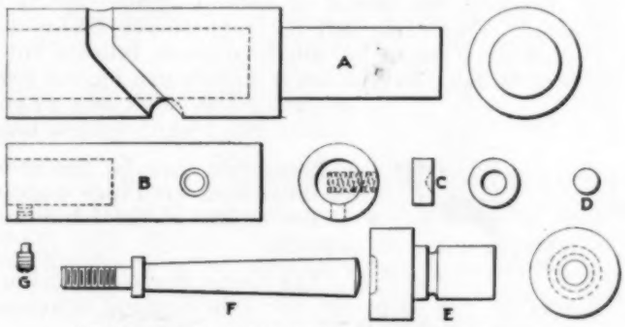
file sections were held in the chuck of a speed lathe and each end used until worn out. A boy fed the shells over the revolving file and pressed down on the bur at each hole in turn. This proved a quick and satisfactory way of doing an awkward job. The only other way of burring was by hand filing, which was exceedingly slow because the bur, being so near the bottom of the shell, necessitated a very short stroke, and the file would continually slide off the ridge formed by the external crease.

Quick-Operating Ball-Bearing Center

By George Blake

Chester, England

The tool here described has been found very useful for machining the outside diameters of flat disks, washers, etc., which could not be held in the ordinary chucks to be machined. Referring to the illustrations the sleeve *A* takes the plunger *B* with center *E*, which revolves on a



QUICK-OPERATING BALL-BEARING CENTER

single ball *D*. *B* is bored out so as to allow a hardened-steel button *C*, with a small hollow for the ball seating, to be pressed into the bottom, the center also being hollowed out so as to allow it to rotate freely on the ball. The groove on the shank of *E* is for a retaining screw *G* to prevent the center coming out. An angular slot is cut in the sleeve *A*, extending halfway round the diameter as shown. The angle of the slot is 45 deg. for three-quarters of the travel of the handle *F*, the rest of the slot being at 90 deg.

The tool is set so that when it is brought up against the disk or washer the handle is nearly at the end of its travel and requires to be forced into position; the washer thus held is ready for machining. To loosen the washer the operator simply pulls the handle back, the washer dropping out. A small spigot is placed in the chuck so as to hold the washer or disk in position. The shank or sleeve can be made to fit either a capstan head or the tailstock of a lathe. The sleeve *A*, plunger *B* and handle *F* are of mild steel, the center *E* and button *C* are of tool steel hardened, while *D* is an ordinary ⅛-in. steel ball.

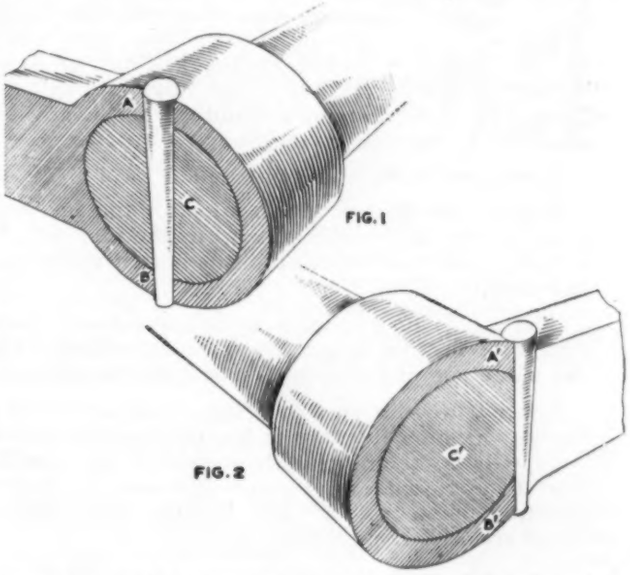
When assembling, a little vaseline or grease should be put in the bore of the plunger after the button is pressed into position.

Two Ways of Using a Taper Pin

By Miles C. Smith

The sketches illustrate two ways of using a taper or straight pin to hold a collar on a shaft or for similar purposes.

Fig. 1 represents the method usually employed, and subjects the pin to a shearing strain at points *A* and *B;* consequently the shaft *C* will hold only until there

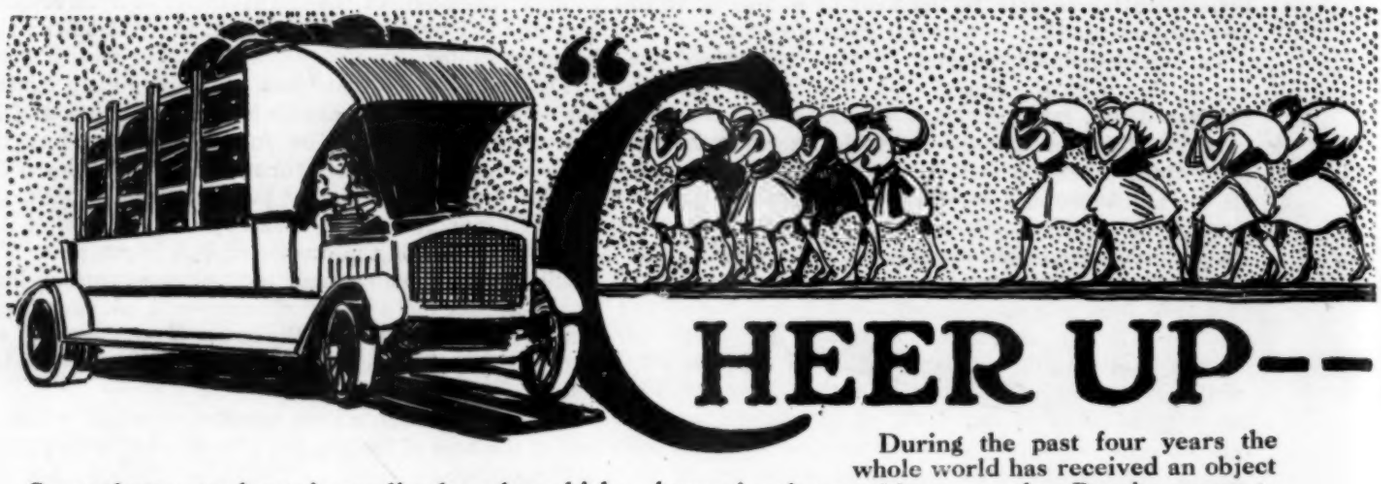


FIGS. 1 AND 2. TWO WAYS OF USING A TAPER PIN

is sufficient pressure to shear the pin. The pin hole through the center of the shaft also tends to weaken that member.

Fig. 2 I have found to be the better method no matter whether the shaft is to be held from turning or from end thrust. By using this method the taper pin has all the functions of a key and the shaft is weakened in no material way. The circumstances and relative characters of the parts to be pinned will determine which side of the shaft should be drilled, but in any event the pin hole should be so located as to be two-thirds in the shaft and one-third in the outer member.

I trust this may be of value to your readers.



CHEER UP--

Some gloom merchants in our line have been kicking off the quilts and then lying in bed damning the cold.

These fellows seem to think that the job of reconstruction is going to be done by hand. We have a tip that it is to be done by machinery.

A dirty-faced, ragged and pessimistic newsboy was lamenting that the war was over because it would put an end to his profitable business in war extras. Along came another urchin of similar appearance, but saner type of mind, who said to the pessimist: "Say, what's bitin' youse, anyway? Ain't de Kaiser licked? Get busy and sell dese extry's about de big peace conference!"

There you have it in a nutshell.

Now is the golden opportunity for the far-seeing man, for the far-thinking man, for the man who has a better idea in his head or a better machine in his shop.

The man who carries a grouch and fears for the future of the machinery business is suffering from the same complaint as the pessimistic newsboy.

Even if all the war contracts were canceled tomorrow, which they won't be, the machinery business will be booming again inside of six months—and it's booming now if you only knew it. A pretty positive statement, isn't it? But the facts that back it up are just as positive.

FACT NUMBER 1 is that this old world moves on wheels.

Where you find wheels you find civilization and progress. Where you don't find them you find the cannibals eating the missionaries.

Every time you see a wheel turning you can find a machine back of it somewhere.

A hundred years ago most of the dirty work and the heavy work and the tedious work of the world was done by hand. For a hundred years we have been gradually getting away from this and toward the goal in which most of the dirty and the laborious and the tedious work will be done by machinery; but never during these hundred years has there been a stimulus toward this goal similar to the one which has just been applied.

During the past four years the whole world has received an object lesson in what machinery can do. Russian peasants who had never before left the confines of their hamlets have ridden on trains and seen caterpillar tractors and excavating machines.

French and English and American mechanical genius has been on continuous exhibition before a selected audience drawn from all countries of the world.

People who have believed for years that human arms and backs and legs were the principal means of transportation have seen one man and a motor truck carry more and faster than a hundred men could carry.

What has happened in our own country? Shops which had never used a limit gage have become skilled in working to small tolerances. Toolmaking skill has multiplied in astonishing fashion. Factories have interchanged their ideas through the medium of the technical press until each one has borrowed something of the best, and the general average has been raised.

The mechanical ability of the United States has been under intensive cultivation, and has grown in proportion to the requirements exacted from it.

FACT NUMBER 2 is that wages are abnormally high.

Look at the string of coolies at the top of this page. You can't sell their employer labor-saving machinery when he can hire these fellows for six cents a day. In Mexico it doesn't pay a mine owner to put in a hoist as long as cheap Indian labor can climb a ladder.

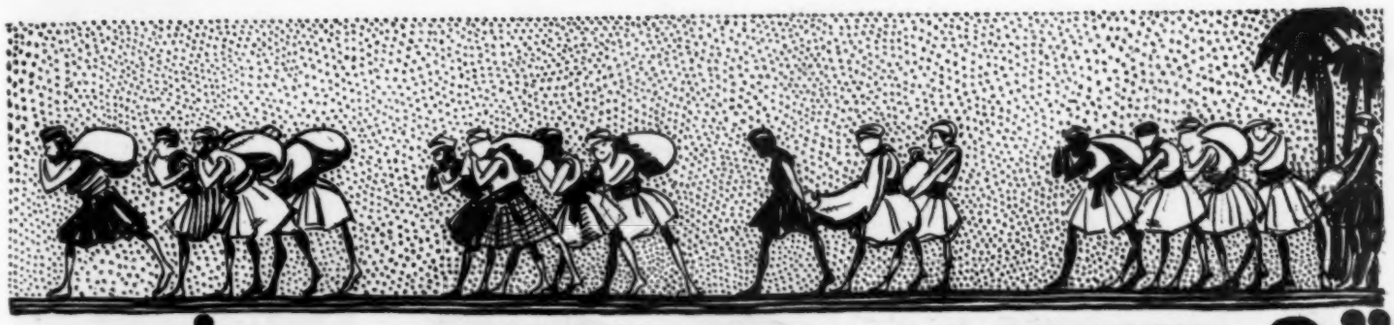
Necessity may be the mother of invention, but a high wage rate is the daddy of the labor-saving machine.

The higher the cost of labor the greater the demand for labor-saving machinery.

With labor at $2 a day it may be questionable about buying that labor-saving machine of yours. With labor at $4 a day there is no question about it. In it goes.

FACT NUMBER 3 is that prices of manufactured products are up in the air.

During normal times the prices of all manufactured products followed a gradual but persistent



AIN'T *the* KAISER LICKED?"

rate of reduction. This in spite of the fact that during these normal times wages have shown an equally gradual but persistent rate of increase.

What is the answer? Why can prices of commodities come down while the wages of those that make them go up?

Simply because machinery puts its weight on the low-price side of the see-saw and overbalances the weight of Mr. Wages.

In other words, normal progress means the improvement and development of machinery at a gradually increasing rate and its continual and progressive application to hand work.

Labor-saving machinery is the only thing in the world that can bring down prices without knocking the bottom out of wages. Price regulation can't do it, Congressional legislation can't do it, employers' associations and labor unions can't do it.

The makers of machinery have got to do it!

FACT NUMBER 4 is that industry has just signed a contract to undertake the biggest job in the history of the world,

and that is to supply the needs of millions of people who have been going without what they need for fifty months.

Railroads have been getting along without equipment. People with plenty of money have been using last year's automobiles. Women have gone without things to wear. Food has been scarce and high-priced.

All because of a shortage of labor.

The end of the war doesn't suddenly alter these facts and make labor plentiful. Instead, it sets hundreds of millions of people to wanting normal things again. It creates new demands, the greatest of which is for price reduction.

Here is where we shine. We must invent new jobs for existing machinery and new machinery for existing jobs.

The fellows who have kicked off the quilts say: "Look at all the machinery that will come from the shell and gun shops. With all of this second-hand stuff on the market, machinery building will be a dead issue!" Wrong again!

We are not going to be less progressive in this matter than France or England, and these countries are already preparing to rebuild, not by putting a lot of good money into old junk that has suffered fifteen years' depreciation in the last fifty months, but by reëquipping plants to operate with American production methods and with the latest labor-saving machines.

A party of Englishmen visiting this country recently said: "We can't afford to tax ourselves half a million dollars a year for the next five years for the sake of saving a half a million dollars this year." They had reference to the fact that they intended to ignore for industrial purposes the vast amount of war machinery with which their plants were filled.

Buying ideas have expanded in proportion to the loosening of purse strings during the last four years. Purchasing vision has a new horizon.

It is going to be mighty hard for the man who stands still to keep up with the procession.

Now is the time to feed the scrap pile. If you are going to keep up with the new rate at which this old world is spinning you must make every machine in your shop give twice a year a valid and convincing reason why it should continue to occupy floor space. Post the offer of a standing reward of $10 to any man who will give a valid reason why any machine in your plant should be scrapped.

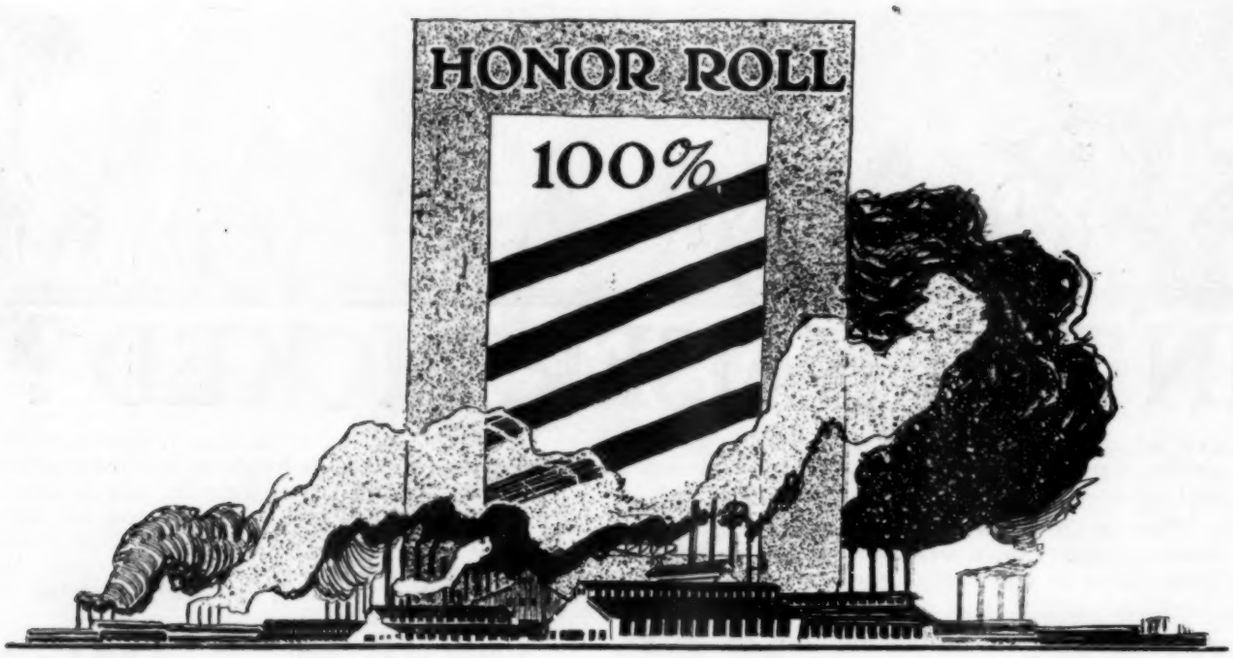
"Scrap the machines and save the business" is a better motto than "Save the machines and scrap the business."

It's going to be a bad ten years for the fellows who keep a month behind the times and a glorious ten years for the fellows who keep a month ahead of the times.

There never was or ever will be a more golden opportunity for the man who builds labor-saving machinery. If you have a product that will do efficiently with wheels what hands have done and are doing gird up your loins and get ready for the biggest run of "pure merit" business that ever happened.

Today is the day for the New American, the man with ideas and ideals and push.

John H Van Deventer



Fourth Liberty Loan in American Machine Shops

(*Second List*)

Allen Machine Co., Erie, Penn.

Anaconda Copper Mining Co. (Foundry Department), Anaconda, Mont.

Anderson Pattern Works, Erie, Penn.

Atlas Machine Co., Providence, R. I.

Bay City Foundry and Machine Co., Bay City, Mich.

Bay City Forge Co., Erie, Penn.

Burke Electric Co., Erie, Penn.

Cascade Foundry Co., Erie, Penn.

Cincinnati Milling Machine Co., Cincinnati, Ohio.

Erie Bolt and Nut Co., Erie, Penn.

Erie City Iron Works, Erie, Penn.

Erie Engine Works, Erie, Penn.

Erie Forge Co., Erie, Penn.

Erie Foundry Co., Erie, Penn.

Erie Forge and Steel Co., Erie, Penn.

Erie Metal Products Co., Erie, Penn.

Erie Malleable Iron Co., Erie, Penn.

Erie Specialty Co., Erie, Penn.

Erie Steel Construction Co., Erie, Penn.

Erie Stove and Manufacturing Co., Erie, Penn.

General Electric Co., Erie, Penn.

Globe Iron Works, Erie, Penn.

Hansen Machine Works, Sacramento, Calif.

Jarecki Manufacturing Co., Erie, Penn.

Krantz Manufacturing Co., Erie, Penn.

Hibbard, L. R., Los Angeles, Calif.

Lester & Wasley Co., Norwich, Conn.

Modern Tool Co., Erie, Penn.

Nagle Engine and Boiler Works, Erie, Penn.

Pennsylvania Art Steel Co., Erie, Penn.

Pennsylvania Boiler Works, Erie, Penn.

Standard Die and Tool Works, New York

Schickel Motor Co., Stamford, Conn.

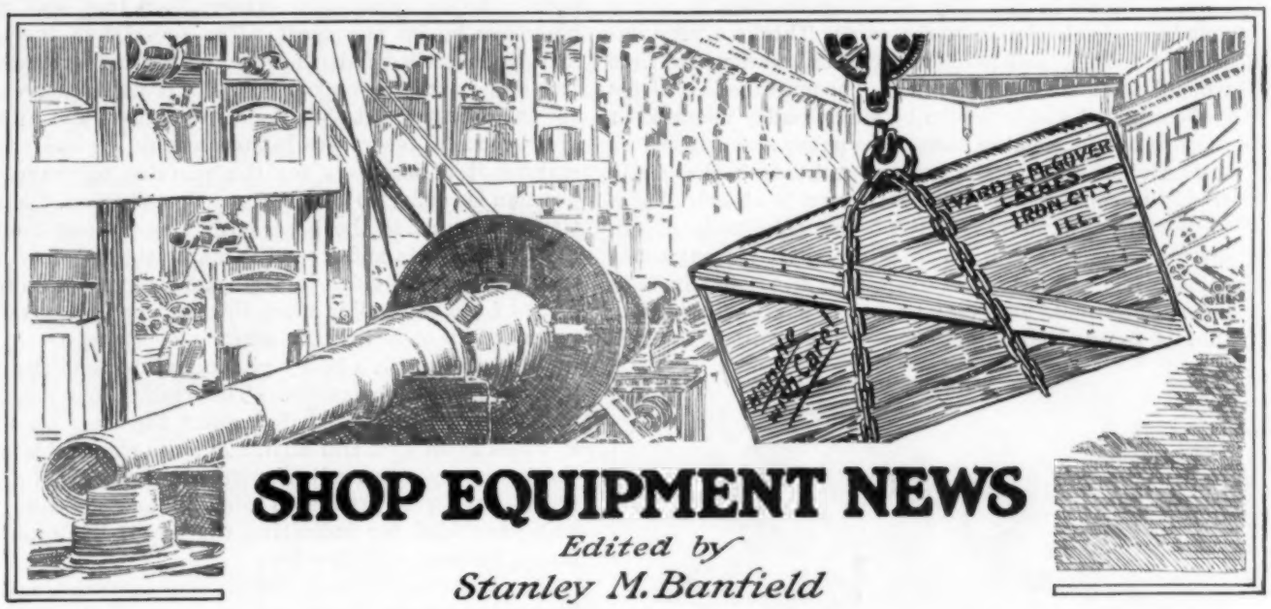
Sterling Aluminum Co., Erie, Penn.

Standard Stoker Co., Erie, Penn.

Standard Pattern Works, Erie, Penn.

Superior Bronze Co., Erie, Penn.

Victoria Metal Co., Erie, Penn.



SHOP EQUIPMENT NEWS

Edited by
Stanley M. Banfield

In conformity with a Post Office ruling, descriptions of new equipment can only be used in this department which have not been previously or simultaneously advertised in this or any other periodical.

Heald Cylinder Grinding Machine

The Heald Machine Co., Worcester, Mass., has recently placed on the market the No. 65 cylinder grinding machine shown in the illustrations. This machine is intended for production work only where a large number of parts of the same kind have to be machined, and is not intended for use in garages or jobbing shops where a varied line of work is handled. It involves many improvements in construction that have been worked out to make it particularly productive and to make it capable of handling large work such as four and six cylinders cast en bloc to best advantage.

The eccentric grinding head and work table are supported by the solid frame, this type of construction doing away with the sliding adjustable knee and insuring great rigidity. The vertical adjustment necessary is obtained by means of an inclined slide located between the main table and the cross-slide table. As this intermediate slide is adjusted in a direction parallel to the main table it moves either up or down the incline on the main table, thus raising or lowering the cross-slide table and the work-holding fixture. As the machine is intended for production work only, this vertical adjustment is limited to ½ in., which is more than sufficient to take care of all the errors that might occur in any boring operation. It is of course intended that the work-holding fixture should be made of such dimensions as to bring the work to approximately the correct position. One of the features of the machine is the arrangement of the dogs for controlling the travel of the table. These are carried on a bar which is supported by the intermediate slide. By this arrangement any necessary vertical adjustment can be

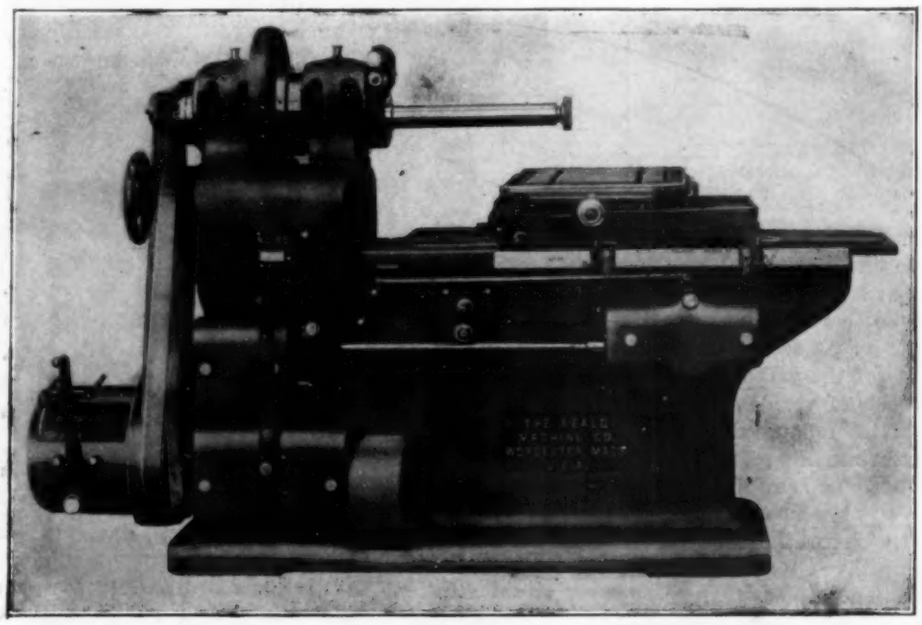


FIG. 1. HEALD NO. 65 CYLINDER GRINDING MACHINE

Capacity with spindle regularly furnished, holes 3 in. in diameter or larger by 15 in. long, spindles for other sizes of work being furnished as extras if desired; grinding wheels for regular spindle, 3½ and 4 in. in diameter, 1¼-in. face, with shaft hole countersunk 2 $\frac{5}{16}$ in. in diameter by $\frac{5}{16}$ in. deep; speed of standard grinding wheel, 6400 r.p.m.; vertical adjustment, ½ in.; traverse adjustment of cross-slide table, 24 in.; micrometer dial for horizontal adjustment; cross-slide table, 36 in. long, 18 in. wide, with adjustment of 24 in.; finished top of table, 28 in. long, 14 in. wide, with two T-slots; maximum distance from finished pad on cross-slide table to center of grinding circle, 7½ in.; floor space, 69 x 112 in.; tight and loose pulleys, 12 x 4½ in.; speed, 950 r.p.m.; net weight, 3850 lb.; motor recommended, 3 hp. with a speed of 1000 to 1200 r.p.m.

made without in any way affecting the travel of the grinding wheel relative to the work. This is a very important feature and is one that saves much waste time when adjustments are necessary. The machine is entirely self-contained and is driven by single pulley mounted at the rear of the machine, and a loose pulley and belt shifter are provided so that the power can be derived directly from the countershaft. This feature is clearly shown in the foreground of Fig. 2. The spindle is driven directly from this main driving shaft through the flexible idler which maintains uniform tension in both belts at all times. This may be seen in Fig. 2. The spring that is in the approximately vertical position controls

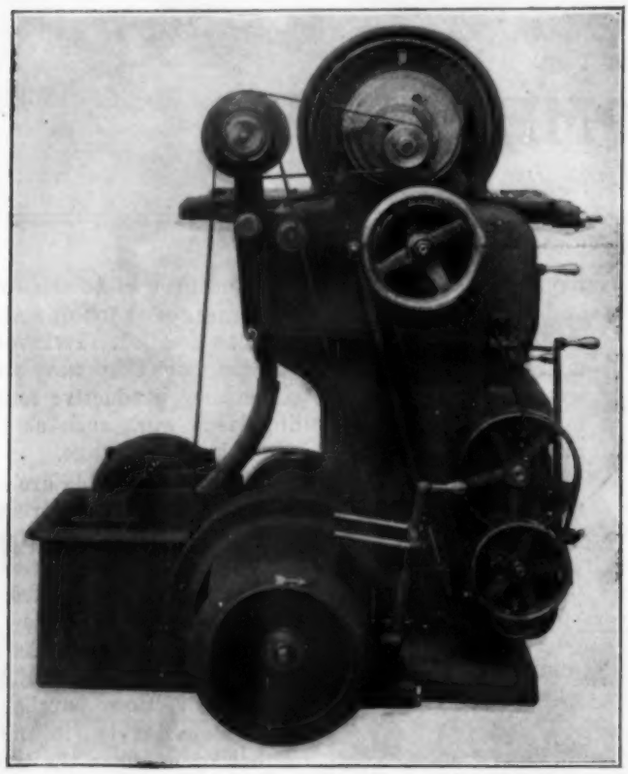


FIG. 2. END VIEW OF THE HEALD MACHINE, SHOWING THE IDLER, DRIVE, BLOWER AND TANK

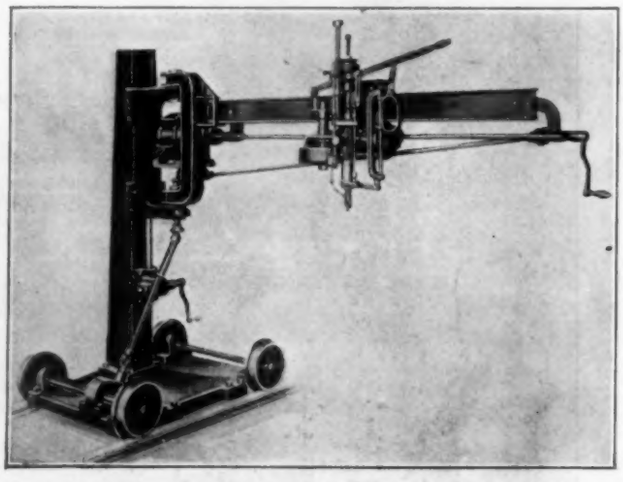
the tension of the belt leading from the main shaft to the idler, while the spring in the horizontal position maintains the tension in the belt leading from the idler to the grinding spindle and takes care of the eccentric motion imparted to this spindle by its eccentric mounting. Various speeds of rotation of the grinding spindle to compensate for grinding wheels of various diameters are provided for by the use of interchangeable pulleys for the wheel spindle, this feature making the machine adaptable for grinding either large or small holes. The main speed box, located at the left lower end of the machine frame, is driven directly from the main drive shaft by means of a belt passing through the base. The drive to the eccentric is through a belt, two speeds being furnished by two pairs of spur gears controlled by friction clutches. The speed box just above controls the travel of the main table and furnishes three rates of speed at which the work is fed past the wheel. It will be noticed that this speed box is connected with the automatic reverse box at the right end of the machine by a plain shaft, the elimination of the knee also eliminating the universal-joint construction that was made necessary by its movement. The reversal of the table may be controlled independently by a hand lever which, it will be noticed, is located in a position convenient for the operator. It should also be noticed that all four of the control levers are located within a small radius, making it unnecessary for the operator to change his position in order to operate any one of them. A friction clutch inside the base, with a convenient controlling lever, starts and stops the main table, while a hand feed has been provided to facilitate in the rapid adjustment of the work slide when this becomes necessary.

The ways on which the main table slides are of the dovetail form with a heavy gib, and oil pockets and rolls provide ample lubrication. The main table has been made of sufficient length to protect the ways on which it slides from grit and dust. A cross-slide table gives the necessary cross adjustment of the work, the feed screw having a graduated dial, adjustable dogs also being provided for indicating the center to center distances between cylinder bores.

Fig. 2 shows the tank for cutting lubricant and the blower, which are located at the back of the machine. The top of the lubricant tank is removable and is made in the form of settling chambers in order to remove as many of the chips as possible. The lubricant flows from one compartment to another over the baffle plates, two of which may be noticed. The chips that are thus removed from the lubricant can be easily cleaned out by removing the top of the tank and dumping the contents.

Reynolds Traveling, Radial, Screw-Driving Machine

The Reynolds Machine Co., Massilon, Ohio, has recently placed on the market the traveling, radial, screw-driving machine shown in the illustration, which is intended for work of such size that the machine must be taken to the work. The machine is known as the



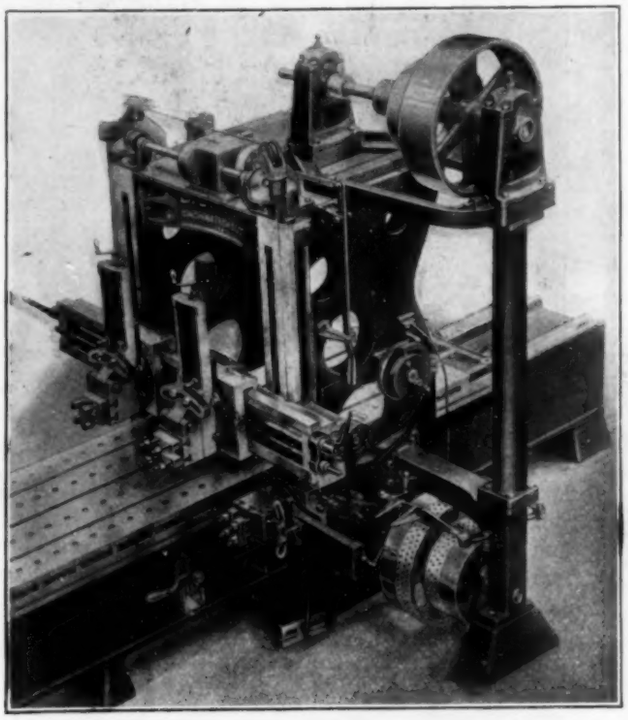
REYNOLDS NO. 5 TRAVELING, RADIAL, SCREW-DRIVING MACHINE WITH MOTOR DRIVE

Reynolds No. 5 radial, and can be equipped to handle a range of screws varying from No. 2, $\frac{3}{8}$ in. in length, to No. 8, 1 in. long. The spindle-bearing driving mechanism and magazine are mounted on a head which is carried on an I-beam, this being attached to a bracket that turns on pivot bearings in a saddle mounted on a

column and adjustable for height within any convenient working range. In the illustration this column is shown mounted on a base with four wheels to run on a track, but it may be mounted on a stationary base if desired Power is provided by a motor placed on the pivot bracket and coupled direct to a splined shaft carried under the beam. The carriage or base has wheel axles mounted in ball bearings and is moved along the track by means of a crank placed at the end of the beam near the operator's position. Connection between the axle and the operating handle is by shafts, bevel gears and universal joints. The carriage is also provided with gibs to connect with the rails as a measure of safety against accidental overturning. The machine will cover a width of 36 in. with angles of 30 deg., or a width of nearly 4 ft. at right angles to the motion of the column. The motor controller is carried on the same bracket as the motor and is within reach of the operator.

Bickett Planing Machine Drive

The Bickett Machine and Manufacturing Co., Cincinnati, Ohio, has introduced a number of improvements in the 36 x 36-in., 42 x 42-in. and 48 x 48-in. planing machines of its manufacture, the improvements relating to the overhead countershaft drive. The improvements aim to overcome the vibration set up when the pulleys are mounted on a bracket supported from the housing only and to overcome the troubles caused by making the three-ply endless belt exceptionally tight when first

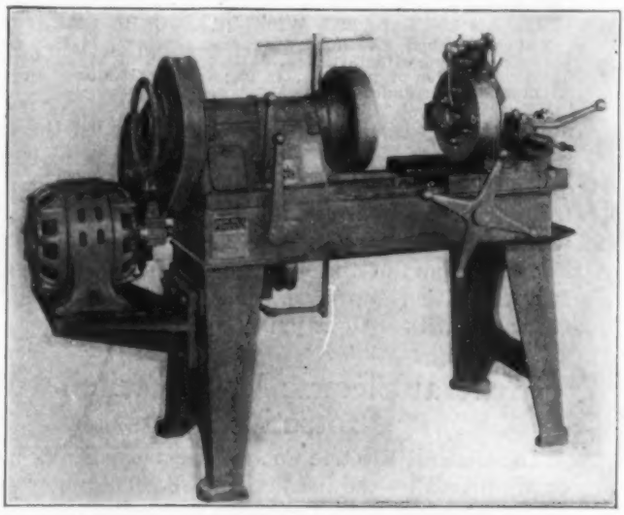


IMPROVED DRIVE FOR BICKETT PLANING MACHINES

put on, which is apt to cause burned-out bearings and other troubles. Vibration is eliminated by providing the overhead countershaft with an outboard support as shown, this support consisting of a cast-iron-pipe column resting on the floor on a supporting base. The difficulty due to tight endless belts is overcome by having the bearings for the countershaft adjustable, both in a horizontal and vertical direction, this adjustment making it possible to so correct the location of the countershaft that the proper belt tension may be secured. The adjustment in a horizontal and vertical direction makes it possible to use a gear drive between the countershaft and the motor, as the combination adjustment obtained allows the proper mesh to be made between the gears. Bearings are of the self-oiling bronze-lined type. No change has been made in the design of the planing machines themselves, which are the regular type with box-type table and inclosed-top bed.

Williams Pipe Machine

One of a new line of pipe machines just placed on the market by the Williams Tool Co., Erie, Penn., is illustrated, the machine shown being known as the No. 1½A. It is made for either belt or motor drive and has a capacity of work from ½ to 3 in. pipe. The die head has a new type of cut-off which uses a V-rest cut-off set at an angle of 45 deg. similar to the V-type cut-off of a



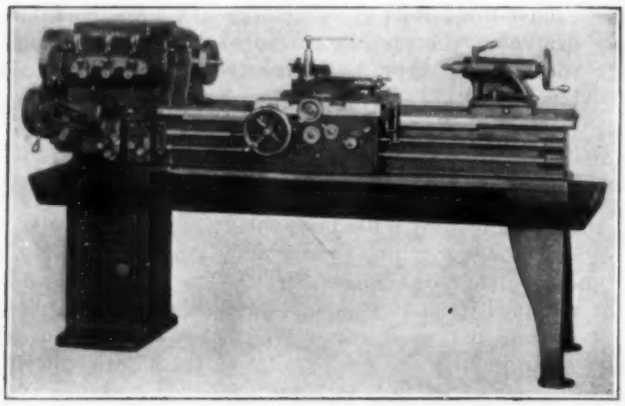
WILLIAMS NO. 1½A PIPE MACHINE WITH MOTOR DRIVE
Weight, 1800 lb.; floor space with belt drive, 36 in. by 4 ft. 6 in.; size of pulley, 3½ x 12 in.; height to center of chucks, 42 in.

screw machine. It is also provided with a reaming tool for removing the bur resulting from the cutting-off operation. Four speeds are provided, these being operated by a lever at the front of the machine. A universal three-jaw chuck is placed at the front end of the spindle and a hand-operated scroll chuck is used at the rear end for steadying the pipe. A belt-driven pump for cutting lubricant is located below the oil sump. On the motor-driven machine special arrangement is made to drive this pump direct from the motor drive.

Willard Geared-Head Lathe

The Willard Machine Tool Co., Inc., Cincinnati, Ohio, has recently placed on the market the geared-head lathe shown in the illustration. This is similar to the 13-in. toolroom lathe formerly manufactured by this company, except that the headstock is all-geared instead of double-back-geared as formerly. The headstock is of box section, with internal ribs for stiffness, the

pulley or drive shaft transmitting the power through three sliding gears to the intermediate shaft gears and providing three initial speeds. From the intermediate shaft two further speeds are transmitted to the sleeve gear on the spindle, making six direct speeds available. The clutch in all of these speeds is thrown into the face gear. Six further speeds are available through the back gears, making a total of 12. Chrome-



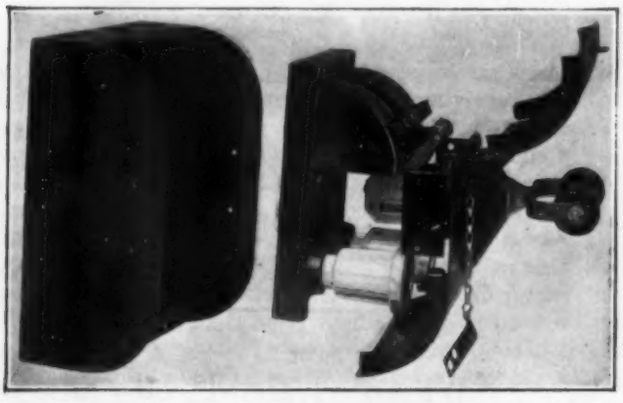
WILLARD 13-IN. LATHE WITH ALL-GEARED HEADSTOCK

Swing over bed, 13¼ in.; swing over carriage, 7¼ in.; distance between centers with 6-ft. bed, 38 in.; travel of tailstock spindle, 5¼ in.; diameter of tailstock, 1¾ in.; taper of centers, Morse No. 3; number of spindle speeds, 12.

nickel-steel gears are used throughout, with the exception of the face gear, which is of cast iron, but this can also be made of chrome-nickel steel at extra cost if desired. The friction pulley, the drive shaft and the intermediate shaft run on antifriction ball bearings. The lower part of the headstock forms an oil reservoir for lubrication purposes. The machine is regularly furnished with a tight pulley and jack shaft.

General Electric Motor Switch with Protective Plugs

The General Electric Co., Schenectady, N. Y., has recently placed on the market the CR 1038 motor switch shown equipped with time-limit protective plugs. The



GENERAL ELECTRIC MOTOR SWITCH WITH TIME-LIMIT OVERLOAD PROTECTIVE PLUGS

switch has been designed for connecting alternating-current motors up to 3 hp., 110 volts, and 5 hp., 220, 440 or 550 volts, direct on the line. The entire device consists of a quick make-and-break switch, below which and inside the sheet-metal case are mounted the time overload protective plugs. These contain a stationary contact post with heating coil and a fusible link which binds a spring contact arm to the stationary post. The motor circuit is completed through the heating coil, post, link and spring contact arm. In case of an overload the current passing through the heating coil will melt the low fusible alloy that holds the link together, thus releasing the spring contact arm and causing it to open the circuit between the contact arm and the post. By reason of the time-lag feature any momentary inrush of current such as at starting will not cause the plug to open the circuit. The illustration reproduces the entire device disassembled in order to show the various parts. When assembled the metal case incloses all parts except the operating handle.

Kent "Keg-Konveyor"

The Kent Machine Co., Kent, Ohio, has recently placed on the market the "Keg-Konveyor" shown, which is said to be of great value in the rapid moving of

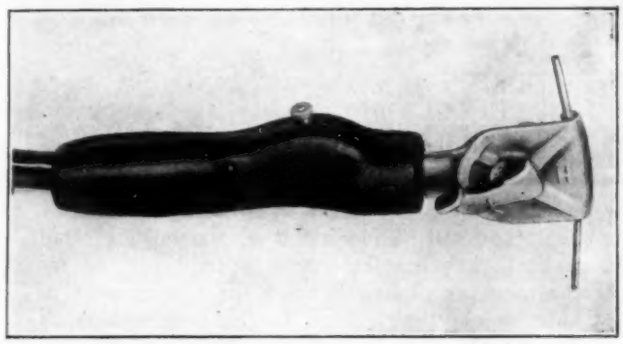
KENT "KEG-KONVEYOR"

kegs with either a light or heavy load. In operation the device is pushed up against the bottom of the keg and the wire loop is thrown over the keg when a backward movement of the handle will lift the keg from the floor. Two spurs at the lower part of the device help to pick up the heaviest load and prevent the keg from slipping in transportation. All wooden parts of the conveyor are made of ash, while metal parts are of wrought iron.

Arc-Welding Electrode Holder

In order to provide a holder for arc-welding electrodes that would overcome some of the troubles that have been common with other holders the Arc Welding Machine Co., Inc., 220 West 42nd St., New York City, has recently placed on the market the holder shown

in the illustration. It is claimed that this device allows the rapid changing of electrodes, but that it holds the electrode firmly enough so that it may be pulled free in case it freezes to the work. The welding current enters at the rear through the end of the composition shank, which holds the electrode, there being no joint except where the cable is soldered into the shank. There is a relatively large contact surface



ARC-WELDING ELECTRODE HOLDER

between the electrode and the holding head, which overcomes any possibility of heating at this point, the electrode being clamped by means of a cam-shaped segment operated by the lever shown. This segment is so installed that any attempt to pull out the electrode results in tightening the grip of the segment, which is made of casehardened steel. The trigger shown at the top is used for the remote control employed with the closed-circuit system manufactured by this company, but whenever this holder is used on other systems this is omitted.

"Bryant" Type 68 Shell Lathes

The R. M. Eddy Foundry Co., Chicago, Ill., has recently placed on the market the Type 68 shell lathes shown in the illustrations. The bed is of the flat-top box type, with rigid drive supports cast integral, and is provided with a chip pan. A small reservoir is provided for catching the cutting compound, from where it is returned by means of a suitable pipe connection

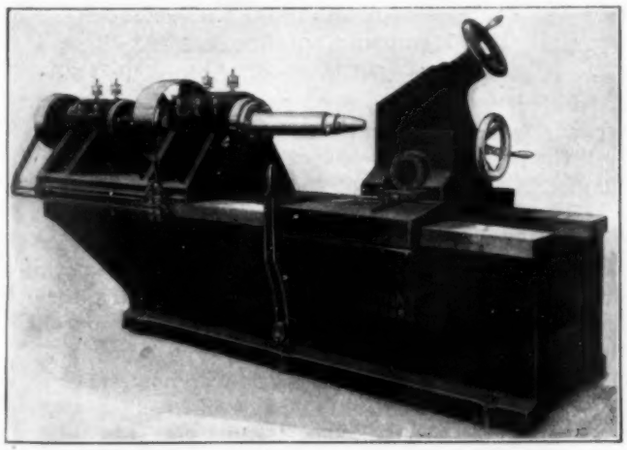


FIG. 1. TYPE 68 RC LATHE FOR BORING THE CENTER TRUE WITH THE INTERIOR OF PROJECTILES

Swing over bed, 28 in.; front spindle bearing, 7 x 14 in.; rear spindle bearing, 5 x 12 in.; width of carriage guide, 7¼ in.; area of carriage bearing, 264 sq.in.; length of carriage guide, 24 in.; driving clutch pulley, 18 x 6 in.; floor space required, 3 ft. by 9 ft. 6 in.; approximate weight, 8500 lb.

to the main reservoir. The head is of massive design, the lower halves of the spindle boxes being cast integral. The mandrel jaws are hardened and operated by an air cylinder attached to the rear end of the spindle, and controlled by a valve within reach of the operator. The standard equipment includes a complete set of gear guards, adjustable sight-feed oil cups, and complete air-operated mandrel equipment, as shown.

Fig. 1 shows the Type 68 RC, which is for boring the center true with the finished interior of projectiles. The spindle is forged of machinery steel, is hollow to receive the draw rod for operating the mandrel and is flanged on the nose end, to which the mandrel is attached. The bearings are of white metal, lubricated by sight-feed oilers mounted on top of the bearing caps. Thrust is taken at the rear bearing and a nut and locknut provide a means of adjustment. The drive is through a 6-in. belt from a line shaft to a friction clutch pulley mounted on the spindle, the drive being controlled by a lever within reach of the operator. The carriage is air operated to permit changing of work and is furnished with a No. 3 Morse taper in the horizontal slide and a 30-deg. angle tool slide for the boring tool.

Fig. 2 shows the Type 68 COC machine, which is for cutting off the open end, centering and testing projectile forgings. The spindle is cast of semisteel and is hollow

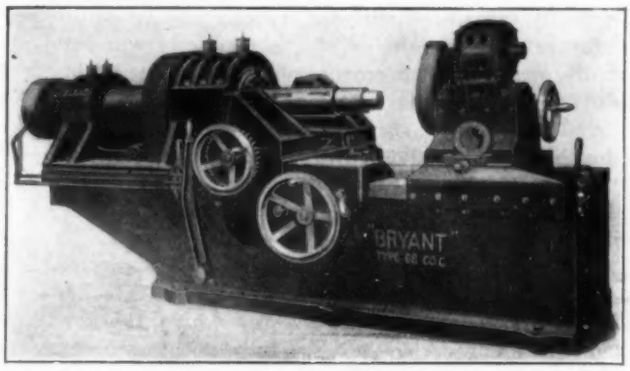


FIG. 2. TYPE 68 COC LATHE FOR CUTTING OFF THE OPEN END, CENTERING AND TESTING PROJECTILE FORGINGS

Swing over bed, 28 in.; front spindle bearing, 12½ x 14 in.; rear spindle bearing, 8 x 10 in.; width of carriage guide, 8 in.; area of carriage bearing, 408 sq.in.; length of carriage guide, 30 in.; driving clutch pulley, 18 x 6 in.; standard gearing ratio, 8¾ to 1; pitch of gearing, 4 in.; floor space required, 3 ft. 6 in. by 10 ft.; approximate weight, 9000 lb.

to receive the draw rod for the mandrel. It runs in white-metal bearings lubricated by sight-feed oilers, the thrust being taken at the rear bearing, which is provided with a means for adjustment. The drive is through a 6-in. belt to a friction clutch pulley mounted on the drive shaft, power being transmitted to the spindle through single gearing of 8¾ to 1 reduction or as the requirements may necessitate. The drive gears are three and four pitch, having a width of face of 4 in. The drive is entirely controlled by a lever within reach of the operator. The cutting-off carriage is of standard design, and is provided with front and rear tool slides operated by a single feed screw having right- and left-hand threads. The power feed is applied through a friction clutch attached to the end of the feed screw. The centering carriage is air operated to permit the changing of forgings, and the spindle is driven by an auxiliary motor mounted on top of the slide.

RECONSTRUCTION NEWS

TIMELY INFORMATION *for* LIVE MACHINE SHOPS

Washington, D. C., Nov. 30, 1918.—The one matter of prime importance to every machine builder—the announcement of a policy regarding cancellation of contracts and the circumstances under which they can be completed—cannot be given at this time. So far as the Navy is concerned it may be said that there will be no cancellation of machine-tool orders except in rare instances, and then each case will be considered with regard for the rights of the contractor. The Navy has a fixed program so far as the need and use of machine tools are concerned, and this program is not likely to be seriously interfered with by the changed conditions. In the case of munitions or of other strictly war products an equitable settlement will be made without undue delay. A letter or telegram to the proper department will bring a prompt reply, perhaps by an inspector being sent who will go over the matter carefully and decide upon the proper course. There is no disposition to shirk any obligation that has been incurred.

The Navy already has a Salvage Division, or bureau, which will handle any cases coming under this head, which may include any supplies for which there will probably be no need. There seems to be nothing to worry about, so far as regards the Navy, as it is an entirely different organization with different needs, which do not affect the machine-tool field as much as Army contracts do.

Many Plans Being Considered by the Army

It must not be assumed that the Army is idle, nor must we forget the difference between the Army and the Navy and their problems. At present, however, it can only be said that many plans are being considered and that it is hoped a decision can be made during the coming week. The question of a Salvage Board is being deliberated on, as was mentioned last week. If the plan be adopted this board will order the completion of a large number of machines of what may be called standard designs and types where the work has progressed to the point of making it better to do so. These tools will then be taken charge of by the board, which will dispose of them to the best advantage at a fair price so as not to disturb the market, even though it be necessary to hold them several years as in the case of the very large tools which are not in everyday demand.

Another plan, and one which might work in with this without difficulty, is to have the builders of the machine complete it and sell it, placing it at the head of their delivery list. The builder would be paid for the machine the same as though it were for Government delivery, and would then return to the Government the price it was sold at, less perhaps a fair remuneration for handling the transaction. Such a charge should, however, be very moderate in view of the fact that the completion of the contract was allowed and the profit on the machine was allowed to accrue to the builder.

When a plan is worked out it will, it is understood, apply to all divisions of the Army, including Aircraft and Ordnance. These two divisions are of the greatest importance to machinery builders and it is to be hoped that the plan to be followed may be decided upon without delay.

The need of a clearing house, whether it be called a Salvage Board or not, can be readily seen. As an example the Shipping Board recently canceled an order for a large plate planing machine, involving several thousand dollars. The board would of course have been obliged to pay for it as it was nearly completed, but the Machine Tool Section of the Finished Products Division of the War Industries Board had knowledge that the Navy needed just this kind of a machine. The cancellation permitted the Navy to get an early delivery, the builders were enabled to get the machine off their hands quickly and our Uncle Samuel was saved a tidy sum of money.

The Machine Tool Section

There is every indication that the Machine Tool Section, which has done such good work during our great emergency, will not continue into the new year. This adds to the necessity for speedy action in finding a way to handle this question and there is little doubt that this will be done. We must remember that the great organizations that have been built up in Washington during the past 20 months are composed of well-known business men from all parts of the country, and they are just as anxious as any of us to see this matter settled and settled right. There are exceptions, it is true. But what organization, no matter how small it may be, has 100 per cent. intelligence in handling matters of this kind? It is a short-sighted policy to think of any organization as a thing apart from the rest of us, for whatever action has been taken is what we may expect from average citizens under the same conditions, no better and no worse.

Supermen exist only in fiction, and when even averag

men are united in huge organizations the safeguards necessary to be used may handicap the men of genius. But in spite of this we must have the big organizations because we are too numerous and too closely interwoven in business to do otherwise. It is only fair to the individual members of the various organizations here in Washington to bear this in mind in order to avoid doing them a grave injustice.

The Working-Conditions Service

The function of the Division of Working-Conditions Service is to develop through scientific study standard policies for the administration of the labor forces in industry and to secure the adoption of such policies by educational methods. The program of the division includes:

Studies of employment systems and labor-management policies, such as methods of hiring, selecting, inducting and assigning employees to their duties, in order to determine the causes of labor turnover and to avoid unnecessary rotation of labor.

Assisting industrial managers in studying their individual employment problems and advising them as to the best methods of hiring and selecting employees, reducing absenteeism and irregular employment, handling grievances, eliminating friction and stimulating morale among the employees.

Establishing a national information center on employment and labor-administration policies for the use of industrial managers, educational institutions and others.

Distributing information on methods of dealing with labor problems in the form of bulletins, pamphlets, addresses to associations and direct answers to inquiries by correspondence.

Formulating standard policies of labor administration and, with the aid of a committee representing all interests affected, promulgating these standard policies to the country and urging their adoption by the industrial managers.

Acting as counselor or consultant on employment methods and policies, and assisting industries to put into operation the standard practices that are recommended.

Promoting facilities for training of labor administrators and assisting industries in obtaining such trained men for their plants.

The New Liberty Fuel

In view of the increasing demands for gasoline, not to mention the increasing price, any authentic information as to a more economical fuel is of widespread intrest not only to the automobilist but to every machine-building firm using internal-combustion engines in any form. Unlike the stories that we have had of new fuels made by dropping some sort of a mysterious pill into water or some other equally inexpensive liquid this fuel is made from kerosene as a base, as is the case with the gasoline now produced. Nor is it one of those accidents that sometimes occur, but a carefully studied method, the result of seven years' work by Edwin C. Weisgerber, Captain of Engineers in the Division of Research and Development. Captain Weisgerber was fortunately placed under the command of Maj. O. B. Zimmerman, who with his long experience in internal-combustion motors not only encouraged him in the face of opposition, but aided him materially by practical suggestions from the motor end.

The possibility of some such accomplishment has been pointed out by Bacon and Hamor under the heading of "Peroxided Kerosene," but it remained for the Engineering Division of the Army, in the person of Captain Weisgerber, to make the matter a reality. The great difference between this process and others is that this is a chemical method while the others now employed are mechanical, and the possibilities of a greatly increased supply of motor fuel at a greatly decreased price make the name Liberty particularly appropriate.

Over seven years ago Captain Weisgerber started work on the problem of finding a gasoline substitute, and his experience took him to various parts of the globe. He had practically perfected the fuel before entering the Army, the additional research and tests giving it the finishing touches. The result is Liberty fuel, which according to reports of the Division of Research Development, has the following characteristics:

The fuel is practically scentless and tasteless and the products of combustion are cooler than with gasoline, which reduces the amount of lubricant necessary as well as the problems of cooling. It is also noncorrosive and has a less deleterious effect on motors than gasoline.

It starts more easily than gasoline and will explode at a temperature below zero, this point being readily controlled in manufacture. It leaves no residue. The effect of the explosion is 30 per cent. greater than gasoline, but this as well as the quality and specific gravity can be controlled at will. It will not explode prematurely, and only ignites from spark or flame.

It has been shown to give greater mileage in airplanes, automobiles, motorcycles, motor trucks and tractors. It requires less air for combustion, can be made at much less cost than gasoline and uses as a base a product (kerosin) which can readily be obtained in any desired quantity. It can be substituted for gasoline for any purpose. It needs no special apparatus and no special engine or carburetor.

During the tests at the Naval Air Station at Anacostia, Liberty fuel was found much superior to the best gasoline, and with the motor running 1600 r.p.m. the water in the radiator never exceeded 160 deg. F. and the oil in the crankcase did not go above 130 deg. This quality of maintaining low temperature may help to solve some of the radiation problems of aviation engineers.

Those interested in the chemical details relating to the temperature of distillation can obtain them from the report of the Bureau of Standards, these tests having been made under the supervision of Dr. Dickinson, who has been in charge of the motor development tests during the war. The fuel is obtained by distillation and the quality can be varied to suit the requirements of different industries.

There have been so many false alarms regarding the problem of fuel for internal-combustion motors that one hesitates to become enthusiastic over a question of this kind, but it seems that Major Zimmerman and Captain Weisgerber have succeeded in producing a new Liberty fuel. The need for such a fuel is beyond question and it is stated that arrangements have been completed for making it available in the near future.

WEEKLY PRICE GUIDE OF

IRON AND STEEL

PIG IRON—Quotations compiled by The Matthew Addy Co.:

	Current	One Month Ago
CINCINNATI		
No. 2 Southern	$37.60	$37.60
Northern Basic	34.80	34.80
Southern Ohio No. 2	35.80	35.80
NEW YORK, Tidewater delivery		
Penna. 2X	39.55	39.15
Virginia No. 2	41.70	41.70
Southern No. 2	41.70	41.70
BIRMINGHAM		
No. 2 Foundry	34.00	34.00
PHILADELPHIA		
Eastern Pa. 2X	39.15*	38.85*
Virginia No. 2	40.50†	40.50†
Basic	36.90*	36.60*
Grey Forge	36.90*	36.60*
Bessemer	39.10*	38.80*
CHICAGO		
No. 2 Foundry Local	34.50	34.50
No. 2 Foundry Southern	39.00	39.00
PITTSBURGH, including freight charge from the Valley		
No. 2 Foundry Valley	35.40	35.40
Basic	34.40	34.40
Bessemer	36.60	36.60

* F.o.b. furnace. † Delivered.

STEEL SHAPES—The following base prices per 100 lb. are for structural shapes 3 in. by ¼ in. and larger, and plates ¼ in. and heavier, from jobbers' warehouses at the cities named:

	New York			Cleveland		Chicago	
	Current	One Month Ago	One Year Ago	Current	One Year Ago	Current	One Year Ago
Structural shapes	$4.27	$4.245	$5.25	$4.17	$5.00	$4.27	$5.00
Soft steel bars	4.17	4.145	5.00	4.07	4.50	4.17	4.50
Soft steel bar shapes	4.17	4.145	5.00	4.17	4.50	4.17	4.50
Soft steel bands	4.77	4.995					
Plites, ¼ to 1 in. thick	4.52	4.495	10.00	4.42	7.00	4.25	9.00

BAR IRON—Prices per 100 lb. at the places named are as follows:

	Current	One Year Ago
Pittsburgh, mill	$3.50	$4.75
Warehouse, New York	4.75	4.75
Warehouse, Cleveland	4.67	4.95
Warehouse, Chicago	4.10	4.50

STEEL SHEETS—The following are the prices in cents per pound from jobbers' warehouse at the cities named:

	New York				Cleveland		Chicago	
	Pittsburgh, Mill, in Carloads	Current	One Month Ago	One Year Ago	Current	One Year Ago	Current	One Year Ago
*No. 28 black	5.00	6.52	6.495	6.445	6.42	5.75	6.52	6.445
*No. 26 black	4.90	6.42	6.395	6.405	6.32	5.65	6.42	6.405
*Nos. 22 and 24 black	4.85	6.37	6.345	6.295	6.27	5.60	6.37	6.295
Nos. 18 and 20 black	4.80	6.32	6.295	6.245	6.22	5.55	6.32	6.245
No. 16 blue annealed	4.45	5.72	5.695	5.645	5.62	5.20	5.72	5.645
No. 14 blue annealed	4.35	5.62	5.595	5.545	5.52	5.10	5.62	5.545
No. 10 blue annealed	4.25	5.52	5.495	5.445	5.42	5.00	5.52	5.445
*No. 28 galvanized	6.25	7.77	7.745	7.695	7.67	7.00	7.77	7.695
*No. 26 galvanized	5.95	7.47	7.445	7.395	7.37	6.70	7.32	7.395
No. 24 galvanized	5.80	7.32	7.295	7.245	7.22	6.55	7.47	7.245

* For painted corrugated sheets add 30c. per 100 lb. for 25 to 28 gage; 25c. for 19 to 24 gages; for galvanized corrugated sheets add 5c., all gages.

COLD DRAWN STEEL SHAFTING—From warehouse to consumers requiring at least 1000 lb. of a size (smaller quantities take the standard extras) the following discounts hold:

	Current	One Year Ago
New York	List plus 13%	List plus 25%
Cleveland	List plus 11%	List
Chicago	List plus 13%	List plus 10%

DRILL ROD—Discounts from list price are as follows at the places named:

	Extra	Standard
New York	35%	40%
Cleveland	35%	40%
Chicago	35%	40%

SWEDISH (NORWAY) IRON—The average price per 100 lb., in ton lots is:

	Current	One Year Ago
New York	$15.50-19	$14.00
Cleveland	20.00	15.00
Chicago	19.00	13.50

In coils an advance of 50c. usually is charged.
Note—Stock very scarce generally.

WELDING MATERIAL (SWEDISH)—Prices are as follows in cents per pound f.o.b. New York, in 100 lb. lots and over:

Welding Wire*		Cast-Iron Welding Rods	
1/4, 11, 5/16, 3/8, 7/16, 1/2 No. 8, 9/16 and No. 10	22.10 to 33.00	1/4 by 12 in. long	16.00
		5/16 by 12 in. long	14.00
		3/8 by 12 in. long	12.00
No. 12		1/2 by 21 in. long	12.00
5/8, No. 14 and 11/16			
No. 18		* Special Welding Wire	
No. 20		1/4	33.00
		5/16	30.00
		3/8	38.00

* Very scarce.

MISCELLANEOUS STEEL—The following quotations in cents per pound are from warehouse at the places named:

	New York Current	Cleveland Current	Chicago Current
Openhearth spring steel (heavy)	8.00	8.00	7.50
Spring steel (light)	10.00	11.25	11.75
Coppered bessemer rods	9.00	8.00	7.07
Hoop steel	4.77	4.75	4.77
Cold-rolled strip steel	8.02	8.25	8.57
Floor plates	6.27	6.00	6.25

PIPE—The following discounts are for carload lots f.o.b. Pittsburgh; basing card of Nov. 6, 1917, for steel pipe and for iron pipe:

BUTT WELD

Steel			Iron		
Inches	Black	Galvanized	Inches	Black	Galvanized
1/8, 1/4 and 3/8	44%	17½%	1/8 to 1¼	33%	17%
1/2	48%	33½%			
3/4 to 3	51%	37½%			

LAP WELD

2	44%	31½%	2	26%	12%
2½ to 6	47%	34½%	2½ to 4	28%	15%
			4½ to 6	28%	15%

BUTT WELD. EXTRA STRONG PLAIN ENDS

1/8, 1/4 and 3/8	40%	22½%	1/8 to 1¼	33%	18%
1/2	45%	32½%			
3/4 to 1¼	49%	36½%			

LAP WELD. EXTRA STRONG PLAIN ENDS

2	42%	30½%	2	27%	14%
2½ to 4	45%	33½%	2½ to 4	29%	17%
4½ to 6	44%	32½%	4½ to 6	28%	16%

Stock discounts in cities named are as follows:

	New York		Cleveland		Chicago	
	Black	Galvanized	Black	Galvanized	Black	Galvanized
¼ to 3 in. steel butt welded	40%	28%	41%	26%	41.1%	26.1%
3½ to 3 in. steel lap welded	36%	25%	37%	23%	37.1%	23.1%

Malleable fittings. Class B and C, from New York stock sell at list + 15%. Cast iron, standard sizes, 5% off.

METALS

MISCELLANEOUS METALS—Present and past New York quotations in cents per pound, in carload lots:

	Current	One Month Ago	One Year Ago
Copper, electrolytic	26.50*	26.00	23.50
Tin in 5-ton lots	71.00	83.00	74.00
Lead	8.05	8.55	7.25
Spelter	8.65	9.50	7.88

* Government price.

ST. LOUIS

Lead	7.75	8.25	7.13
Spelter	8.30	9.25	7.63

At the places named, the following prices in cents per pound prevail, for 1 ton or more:

	New York			Cleveland		Chicago	
	Current	One Month Ago	One Year Ago	Current	One Year Ago	Current	One Year Ago
Copper sheets, base	38.00	38.00	35.00	38.00	36.00	36.00	35.00
Copper wire (carload lots)	35.00	35.00	38.50	35.00	32.00	33.00	33.00
Brass sheets	39.75	39.75	40.00	40.50	35.00	33.50	35.00
Brass pipe	46.00	46.00	43.00	42.50	42.00	44.00	42.00
Solder (half and half) (case lots)	55.00	58.00	39.25	47.00	40.00	56.00	38.00

Note:—Solder very scarce.

Copper sheets quoted above hot rolled 16 oz., cold rolled 14 oz. and heavier, add 1c.; polished takes 1c. per sq.ft. extra for 20-in. widths and under; over 20 in., 2c.

BRASS RODS—The following quotations are for large lots, mill. 100 lb. and over, warehouse; 25% to be added to mill prices for extras; 50% to be added to warehouse price for extras:

	Current	One Year Ago
Mill	$37.75	$29.00
New York	34.25	30.00
Cleveland	38.50	34.00
Chicago	29.50	37.00

SHOP MATERIALS AND SUPPLIES

ZINC SHEETS—The following prices in cents per pound prevail:
Carload lots f.o.b. mill 15.00

	In Casks		Broken Lots	
	Current	One Year Ago	Current	One Year Ago
Cleveland	18.75	20.00	18.40	20.50
New York	17.00	21.00	17.50	21.25
Chicago	22.00	21.00	21.50	21.50

ANTIMONY—Chinese and Japanese brands in cents per pound, in ton lots, for spot delivery, duty paid:

	Current	One Year Ago
New York	9.50–10.50	14.00
Chicago	15.50	16.25
Cleveland	12.00	16.00

OLD METALS—The following are the dealers' purchasing prices in cents per pound:

	New York		Cleveland		
	Current 1918	One Year Ago	Current 1918	One Year Ago	Chicago
Copper, heavy and crucible	23.00	22.00	23.00	21.00	21.50
Copper, heavy and wire	22.00	21.00	22.00	21.00	21.00
Copper, light and bottoms	18.50	19.00	19.00	20.00	21.00
Lead, heavy	7.00	4.75	7.00	5.50	6.20
Lead, tea	6.00	4.00	5.00	4.50	5.50
Brass, heavy	13.00	15.00	15.00	14.00	18.50
Brass, light	10.00	10.50	11.00	11.00	12.50
No. 1 yellow brass turnings	13.00	16.00	12.50	15.00	14.50
Zinc	5.75	5.75	5.50	5.50	5.80

ALUMINUM—The following prices are from warehouse at places named:

	New York	Cleveland	Chicago
No. 1 aluminum, guaranteed over 99% pure, in ingots for remelting (1-15 ton lots), per lb	33.20c.	32.30c.	33½c.

This is the Government price for lots of from 1 to 14 tons.

COPPER BARS from warehouse sell as follows in cents per pound, for ton lots and over:

	Current	One Year Ago
New York	32.00	40.00
Chicago	38.00	40.00
Cleveland	36.50	39.00

BABBITT METAL—Warehouse price per pound:

	New York		Cleveland		Chicago	
	Current	One Year Ago	Current	One Year Ago	Current	One Year Ago
Best grade	90.00	70.00	83.00	80.00	96.00	70.00
Commercial	45.00	40.00	23.00	21.00	25.00	25.00

SHOP SUPPLIES

NUTS—From warehouse at the places named, on fair-sized orders, the following amount is deducted from list:

	New York		Cleveland		Chicago	
	Current	One Year Ago	Current	One Year Ago	Current	One Year Ago
Hot pressed square	$0.80	List	$1.25	$1.30	$0.98	$2.00
Hot pressed hexagon	.80	List	1.05	1.30	.78	2.00
Cold punched hexagon	2.50*	List	.75	List	1.00	1.50
Cold punched square	2.50*	List	.75	List	1.00	1.50

* List plus.

Semi-finished nuts sell at the following discounts from list price:

	Current	One Year Ago
New York	50–10%	50%
Chicago	50%	45%
Cleveland	50–10%	50%

MACHINE BOLTS—Warehouse discounts in the following cities:

	New York	Cleveland	Chicago
½ by 4 in. and smaller	40–10%	40–10%	37%
Larger and longer up to ½ in. by 30 in.	20–5%	20–5%	25–5%

WASHERS—From warehouses at the places named the following amount is deducted from list price.
For wrought-iron washers:
New York..... $2.00 Cleveland..... List Chicago..... $2.50
For cast-iron washers the base price per 100 lb. is as follows:
New York..... $6.00 Cleveland..... $4.25 Chicago..... $4.50

CARRIAGE BOLTS—From warehouses at the places named the following discounts from list are in effect:

	New York	Cleveland	Chicago
½ by 4 in. and smaller	40%	45%	32½%
Larger and longer up to 1 in. by 30 in	20–5%	20–5%	20%

COPPER RIVETS AND BURS sell at the following rate from warehouse:

	Rivets		Burs	
	Current	One Year Ago	Current	One Year Ago
Cleveland	List plus 10%	List plus 10%	List plus 10%	List plus 10%
Chicago	List price	List price	List plus 20%	List price
New York	15% from list	List plus 10%	List plus 5%	10-2½% from list

RIVETS—The following quotations are allowed for fair-sized orders from warehouse:

	New York	Cleveland	Chicago
Steel ⅞ and smaller	40%	45—5%	40%
Tinned	30%	45—5%	40%

Boiler, ½, ⅝, 1 in. diameter by 2 in. to 5 in. sell as follows per 100 lb.:
New York..$5.675 Cleveland...$5.15 Chicago...$5.67 Pittsburgh...$4.65
Structural, same sizes:
New York..$5.775 Cleveland...$5.25 Chicago...$5.77 Pittsburgh...$4.75

MISCELLANEOUS

SEAMLESS DRAWN TUBING—The base price in cents per pound from warehouse in 100-lb. lots is as follows:

	New York	Cleveland	Chicago
Copper	52.00	40.00	45.00
Brass	49.00	38.00	42.00

For immediate stock shipment 3c. is usually added. The prices of course vary with the quantity purchased. For lots of less than 100 lb., but not less than 75 lb., the advance is 2c.; for lots of less than 75 lb., but not less than 50 lb., the advance is 5c. over base (100-lb. lots); for less than 50 lb. but not less than 25 lb., 10c. should be added to the base price; and for quantities of from 10 to 25 lb. the extra is 25c.; less than 10 lb., add 35c.

Double above extras will be charged for angles, channels and sheet-metal mouldings if ordered in above quantities. The above extras also apply to brass rod other than standard stock sizes—stock sizes being considered as ¼ up to 2 in. inclusive in rounds, and ½ up to 1½ in. inclusivein square and hexagon—all varying by thirty-seconds up to 1 in. and by sixteenths over 1 in. On all shipments aggregating less than 100 lb. there is usually a boxing charge of $1.50.

TIN PLATES—Warehouse prices per box:

Coke tin plate, 14 x 20:

	Cleveland		Chicago	
	Current	One Yr. Ago	Current	One Yr. Ago
100 lb	$9.17½	$12.00	$10.60	$11.75
I. C. 107 lb	9.42½	12.17½	10.70	11.90

Terne plate, 20 x 28:

Base Weight	Net Weight	Coating				
100 lb.	200	3	18.95	18.95	19.10	17.90
I. C.	214	8	19.25	19.25	19.40	18.25
I. C.	270	8	21.75	21.75	21.40	20.35
I. C.	218	12	21.75	21.75	22.60	19.25
I. C.	221	15	22.50	22.50	22.10	19.50
I. C.	226	30	23.25	23.25	22.60	20.50
I. C.	231	25	24.50	24.50	23.10	21.30
I. C.	236	30	25.75	25.75	23.60	22.25
I. C.	241	35	26.75	26.75	25.10	23.25
I. C.	246	40	28.00	28.00	25.60	24.55

NOTE—New York prices furnished on application to dealers. Price varies according to whether the plates are wanted for work essential to the war or for nonessential work.

COTTON WASTE—The following prices are in cents per pound:

	New York			
	Current	One Year Ago	Cleveland	Chicago
White	11.00 to 13.00	13.00	16.50	12.00 to 16.50
Colored mixed	8.50 to 12.00	12.00	13.00	11.50 to 14.00

WIPING CLOTHS—Jobbers' price per 1000 is as follows:

	13½ x 13½	13½ x 20½
Cleveland	52.00	58.00
Chicago	48.00	50.00

SAL SODA sells as follows per 100 lb.:

	Current	One Month Ago	One Year Ago
New York	$1.75	$1.75	$1.75
Philadelphia	1.75	1.75	1.75
Cleveland	2.62½	2.40	2.10
Chicago	2.00	2.00	2.00

ROLL SULPHUR in 360-lb. bbl. sells as follows per 100 lb.:

	Current	One Month Ago	One Year Ago
New York	$3.65	$4.30	$4.30
Cleveland	4.25	4.60	4.50
Chicago	4.50	4.00	3.80

COKE—The following are prices per net ton at ovens, Connellsville, and cover the past four weeks:

	Nov. 27	Nov. 21	Nov. 14	Nov. 7	Oct. 31
Prompt furnace	$6.00	$6.00	$6.00	$6.00	$6.00
Prompt foundry	7.00	7.00	7.00	7.00	7.00

FIRE CLAY—The following prices prevail:

		Current
Chicago	450-lb. bbl.	$2.50
Cleveland	375-lb. bag	2.50

LINSEED OIL—These prices are per gallon:

	New York		Cleveland		Chicago	
	Current	One Year Ago	Current	One Year Ago	Current	One Year Ago
Raw in barrels	$1.64	$1.20	$1.90	$1.25	$1.83	$1.18
5-gal. cans	1.89	1.30	2.00	1.40	2.03	1.28

WHITE AND RED LEAD in 500-lb. lots sells as follows in cents per pound:

	Red				White	
	Current		1 Year Ago		Current Dry and In Oil	1 Year Ago Dry and In Oil
	Dry	In Oil	Dry	In Oil		
100-lb. keg	14.00	14.50	12.25	12.50	14.00	12.50
25 and 50-lb. kegs	14.25	14.75	12.50	12.75	14.25	12.25
12½-lb. keg	14.50	15.00	12.75	13.00	14.50	12.50
5-lb. cans	....	.....	14.25	14.00	16.00	14.50
1-lb. cans	....	.....	14.25	14.50	17.00	14.50

NEW *and* ENLARGED SHOPS

Consult the Buying Section when in need of machinery or supplies

WASHINGTON, D. C.

The Navy aims to give information regarding its purchases to all manufacturers known to be in a position to supply its demand. Owing to the need of prompt action in the cases of all machine tools hereinafter listed, the Navy cannot arrange to permit a postponement of the opening of bids if the manufacturers are able to secure bidding forms and submit their bids prior to date fixed for opening.

In case time does not permit this, it will be appreciated if any manufacturer not receiving information directly regarding these purchases will notify the Purchasing Division, Bureau of Supplies & Accounts, Navy Department, Washington, D. C., in order that the firm's name may be properly listed for all future purchases.

The Bureau of Supplies and Accounts, Navy Department, will soon receive bids furnishing machines and machine tools as follows:

Schedule No. 7201½, 6 turret lathes, delivery Washington, D. C.

Schedule No. 7223½, 2 ash hoisting machines.

Schedule No. 7242½, 4 milling machines, delivery Washington, D. C.

Schedule No. 7244½, splitting shears, combined lever, punch and shear, bending rolls, delivery Sewalls Point (Norfolk P. O.) Va.

Schedule No. 7245½, 4 drilling machines, delivery Alexandria, Va.

Schedule 7246½, drilling machines, delivery Alexandria, Va.

Schedule No. 7247½, drilling and lapping presses, delivery Alexandria, Va.

Schedule No. 7248½, drilling machines, delivery Alexandria, Va.

Schedule No. 7249½, drilling machines, delivery Newport, R. I.

Schedule No. 7295½, turning machine, delivery Brooklyn, N. Y.

Schedule No. 7308½, miscellaneous twist drills, delivery Puget Sound (Bremerton P. O.), Wash.

Schedule No. 7309½, 1000 portable drills, delivery various eastern yards.

The Bureau of Supplies and Accounts, Navy Department, will receive bids furnishing machines and machine tools as follows:

Dec. 6—Schedule No. 7140½, 2 vertical boring and turning mills, delivery Washington, D. C.

Schedule No. 7179½, 1 hydraulic press, delivery Brooklyn, N. Y.

Schedule No. 7183½, 1 squaring shears, delivery Boston, Mass.

Schedule No. 7206½, 1 sensitive drill, delivery Philadelphia, Penn.

Schedule No. 7232½, saw sharpening machine, delivery Washington, D. C.

Dec. 9—Schedule No. 7297½, variety saw, delivery Pensacola, Fla.

Dec. 10—Schedule No. 7314½, 1 outside molder, 1 variety saw and 1 vertical shaper, delivery Cape May, N. J.

Dec. 13—Schedule No. 7296½, sand blast machine, delivery Boston, Mass.

Schedule No. 7318½, miscellaneous straight shank drills, delivery Newport, R. I.

Schedule No. 7322½, 1 precision lathe, delivery Boston, Mass.

Schedule No. 7334½, 1 rubber testing machine, delivery Boston, Mass.

Schedule No. 7278½, 2 turret lathes, delivery Charleston, S. C.

Schedule No. 7279½, 1 centering machine, delivery Washington, D. C.

Schedule No. 7292½, 2 shapers, deliv ry Washington, D. C.

Dec. 16—Schedule No. 7295½, turning machine, delivery Brooklyn, N. Y.

Schedule No. 7321½, one 16 in. and one 24 in. crank shaper.

Schedule No. 7331½, 2 polishing machines, delivery Alexandria, Va.

Schedule No. 7336½, 1 single spindle shaper, delivery Portsmouth, N. H.

Schedule No. 7319½, 1 metal planer, delivery North Charleston, S. C.

Schedule No. 7272½, 2 drill grinders, delivery Puget Sound (Bremerton P. O.) Wash.

METAL WORKING

NEW ENGLAND STATES

Conn., Derby—The General Ordnance Co., New London, has had plans prepared for the erection of a 60 x 250 ft. extension to its machine shop here. Noted Nov. 28.

Conn., West Hartford (Hartford P. O.)—The W. R. Bennett Co., recently incorporated with $100,000 capital stock, has awarded the contract for the erection of a 1-story, 35 x 75 ft. factory, for the manufacture of furnaces, machinery, etc. M. J. Bennett, New Britain Ave., Elmwood, incorporator.

Mass., Shelburne Falls (Boston P. O.)—The Mayhew Steel Products Co., 295 Broadway, New York City, manufacturer of small tools, has awarded the contract for the erection of three 1-story, 40 x 100 ft., 100 x 300 ft. and 40 x 100 ft. factory buildings here. Estimated cost, $115,000. Noted Nov. 28.

Mass., State Line—The New York, New Haven & Hartford R. R., New Haven, Conn., will build a round house, machine shop and turntable building. Estimated cost, $80,000.

Mass., Westfield—The Westfield Manufacturing Co., Cycle Ave., manufacturer of bicycles and motor cycles, has awarded the contract for the erection of a 1½ story, 43 x 186 ft. and 25 x 63 ft. factory and storehouse. Estimated cost, $40,000. Noted Nov. 14.

MIDDLE ATLANTIC STATES

D. C., Washington—A. L. Flint, Purchasing Agent for Panama Canal, Wash., will receive bids until Dec. 10, for furnishing machines and machine tools as follows: twelve ¼ in., twelve 7/16 in., six ½ in., twenty ¼ in. and two 1 in. bit stock, square taper shank drills; 12 each of 7/16 in., ½ in., ¾ in., 7/8 in., ¼ in. and ¾ in. blacksmiths or post, half round, ¼ in. straight shank drills; thirty 7/64 in. No. 1 shank, twenty-four 9/32 in. No. 1 shank, sixty 11/32 in. No. 1 shank, twenty-four 23/32 in. No. 2 shank, sixty 29/32 in. No. 3 shank, twelve 33/32 in. No. 3 shank, fifteen 1¼ in. No. 4 shank twist, Morse taper shank drills; twelve 5/16 in., six 21/32 in., three 23/32 in., three 29/32 in., three 27/32 in., two 29/32 in., two 15/16 in. and two 1 1/16 in. square taper shank, No. 1 ratchet twist drills; fifteen 3/64 in. and thirty-six ¼ in. straight shank twist drills; 18 No. 9, 36 No. 10, 60 No. 12, 24 No. 13, 12 No. 14, 18 No. 20, 12 No. 21, 36 No. 28, 12 No. 60, 12 No. 69, round straight shank, wire gauge, twist drills; 48 No. 7, 42 x 42 ft. and 18 No. 11, 13 x 13 ft. combination, counter sinking drills to be equal to the Cleveland Twist Drill Co.'s No. 98; 12 No. 12 A breast drills, to be ball bearing, cut steel gears, alligator jaws, holding both round and square shanks, hardwood handles, drills to have two speeds, 1-3 and 1-1, chuck to be heavily nickel plated and to be equipped with one set of jaws for all sizes of drills, drive gear to be about 5 in. diameter equal to No. 12 A, Millers Falls Co.; three ½ in. No. 6, eight ½ in. No. 8, two 1 in. No. 10, two 13/16 in. No. 10, one 1 in. No. 10, two 1 in. No. 11, one 1 in. No. 13, eight 1 in. No. 14, split, round, adjusting machine screw dies, equal to those shown on page 77 of Pratt & Whitney Co.'s catalogue No. 7; three, 16 in. diameter, 14 guage, 1¼ in. arbor, 60 teeth, 2000 r.p.m.; five 18 in. diameter, 13 gage, 1¼ in. arbor, 60 teeth, 2000 r.p.m., hand feed, solid teeth, cut off circular saws; six 15 in. diameter, 13 gage 1¼ in. arbor, 60 teeth, right hand solid teeth, rip, circular saws; 6 No. 2 pipe cutters, cutting ¼ in.-2 in. and 6 No. 6 pipe cutters, cutting 6 to 8 in., equal to Barnes; 6 No. 2 straight shank and 6 No. 3 straight shank, tool holders, each complete with wrench and two cutters, to be equal to those manufactured by Armstrong Bros. Tool Co.; thirty-six ¼ lb. and twenty-four ½ lb. ball peen handled machinists hammers, to be forged tool steel, hardened and tempered, polished faces, octagon pattern, handled, high grade and manufacture; manufacturers' name and weight to be stamped on each hammer. Handles to be securely fitted and well proportioned and finished, made of well seasoned, straight grained apple wood or second growth hickory. Specified weight is for tools without handles; three 150 lb. blacksmiths' anvils to be in accordance with Panama Canal Specifications No. 481.

Md., Baltimore—The Crown Cork and Seal Co., 1511 Guilford Ave., will build a 2-story, 100 x 150 ft. garage on Federal St. near Guilford Ave. Estimated cost, $50,000.

Md., Baltimore—The Magneto and Machine Co., 1034 Cathedral St., plans to erect a machine and automobile repair shop.

Md., Hagerstown—The Pangborn Co., Maryland Park, is building a 2-story, 40 x 70 ft. addition to its plant for the manufacture of sand blast apparatus.

Md., Hagerstown—The Western Maryland R. R., Continental Bldg., Baltimore, has awarded the contract for the erection of a 1-story, 100 x 130 ft. car and general repair shop. Estimated cost, $40,000.

Md., Hancock—The Hancock Foundry Co., incorporated with $25,000 capital stock, has acquired a foundry and plans to enlarge same. R. M. Daniels.

N. J., Bound Brook—Fire recently damaged the plant of the Bound Brook Engine Works.

N. J., Bound Brook—Fire recently damaged the plant of the Metals Disintegrating Co., East Main St.

N. J., Bound Brook—Fire recently damaged the plant of the Bound Brook Stove Works.

N. J., Elizabeth—The Duesenberg Motors Corporation, Newark Ave., has taken over additional property and plans to erect an addition to its plant.

N. J., Garwood—The National Boiler Co., South Ave., has awarded the contract for the erection of a 1-story, 100 x 105 ft. foundry addition to its plant. Noted Nov. 21.

N. J., Irvington—Gould & Eberhardt, Chancellor Ave., have awarded the contract for the erection of a 1-story, 40 x 70 ft. garage.

N. J., Jersey City—The Vulcan Iron Works, foot of Morris St., has awarded the contract for the erection of an addition to its plant. Estimated cost, $50,000.

N. J., Newark—Kraenter & Co., Inc., 571 18th Ave., is in the market for 6 large Briggs millers or No. 7H Becker millers.